

INTERNET ADOPTION IN POST-COMMUNIST COUNTRIES:  
A PROPOSED MODEL FOR THE STUDY OF INTERNET DIFFUSION

By

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This dissertation proposed and tested a five-dimensional theoretical framework to explain the variations in Internet use across the post-communist countries. The framework included economic, political climate and policy, technology/infrastructure, cultural, and audience factors. Three factors emerged as critically important: economic, political, and infrastructure factors. Cultural factors seemed to have partial impact. These findings suggest that the traditional country-level indicators of economic wealth and technological infrastructure remain important determinants of Internet use in the countries of Eastern Europe and the former Soviet Union. The most significant determinant, however, was level of democratization.

The results of the multiple regression analysis reported in this study indicate that democratization, teledensity, and GNP per capita were the three most important factors positively related to Internet use in the post-communist countries. Being predominantly Muslim had a negative effect on Internet use while being Western Christian (Protestant or

Catholic) seemed unrelated to Internet adoption. Neither length of telecommunications privatization nor education level appeared significant in this analysis.

Thus, the results of this study shed light on the macro-level indicators that affect Internet adoption in the post-communist countries. These have important implications for policy makers at the local, national, and international level. The proposed Internet diffusion model may be applicable to other regions, but this analysis focused only on the 28 post-communist countries.

## CHAPTER 1 INTRODUCTION

Human history has witnessed the rise and fall of many new technologies. The Internet is often described as the most revolutionary new technology ever and its growth in every country around the globe is remarkable as well as irreversible. The Internet is not just a technological innovation; it is a unique, fascinating, multifaceted network that transcends national boundaries. It affects people, communities, organizations, and countries around the world. In this dissertation, Internet adoption is examined in a unique region of the world--the post-communist countries.<sup>1</sup> The dissertation proposes a five-dimensional analytical framework to account for differences in Internet diffusion in those countries. Testing the five-dimensional framework identifies the main determinants of Internet adoption and illustrates how these determinants affect Internet use in the post-communist countries.

### **Internet Significance**

The Internet constitutes "at once a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographical location" (Leiner et al., 1997). The Internet has affected society in a variety of ways as a

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<sup>1</sup> The post-communist countries are defined as the countries of Eastern Europe, the former Soviet Union, and Mongolia. Specifically, the study examines Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia (FYROM), Moldova, Mongolia, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Yugoslavia (Serbia and Montenegro).

result of its multidimensional functions (Castells, 1996; ITU, 1999; Newhagen & Rafaeli, 1996; OECD, 1998b). One of the most fascinating aspects of Internet diffusion is its impact on a global scale. The Internet has exercised a tremendous impact on the economic, political, technological, and social development of countries (IMF, 2000a; Mitchell, 1995; World Bank, 2001). The positive contributions of Internet adoption in each of these four areas are reviewed below.

### **Economic Contributions**

One of the more compelling arguments made to encourage global Internet diffusion is that countries (developing countries in particular) can improve their economic status with the adoption of this technology (Hanson & Narula, 1990). Clearly, the Internet affects the economic situation in a country as it facilitates international trade, lowers production and distribution costs, optimizes productivity within and between companies, and offers leapfrogging possibilities for less developed countries.

The Internet facilitates international trade and thus allows nations to increase exports and imports of goods to and from other countries (The new economy, 2000). It allows better integration of national markets both internally and externally/internationally, and also increases possibilities for economic decentralization (Maddock, 1997). With the improvement of Internet security, e-commerce is expected to increase and more national exports and imports will be likely (DePrince & Ford, 1999).

In addition, the Internet lowers production and distribution costs (DePrince & Ford, 1999; Guthrie & Austin, 1996; The new economy, 2000). These lower costs can have a positive effect on the internal economic situation. The Internet intensifies price competition among producers, which leads to lower prices for consumers (Guthrie &

Austin, 1996). Labor productivity is increased, and searching, distribution, and transaction costs tend to drop (DePrince & Ford, 1999).

It has been argued that the Internet optimizes productivity within and between companies (Maddock, 1997; Malecki, 1997, 2000). The development of a better telecommunications infrastructure in general, Maddock (1997) argues, increases productivity and competitiveness of local companies. In addition, telecommunications development facilitates economic growth by increasing market efficiency (Maddock, 1997). Finally, better telecommunications can improve management within corporations (Daly & Miller, 1998; Maddock, 1997).

Another economic impact of higher Internet penetration is the leapfrogging effect. Leapfrogging is the ability of countries that are technologically behind suddenly to skip generations of intermediate technology and adopt the latest one. The adoption of the latest technology is seen as beneficial to countries as they can succeed in catching up economically with more technologically advanced societies (Singh, 1999).

### **Political Contributions**

In addition to the economic benefits, the Internet can serve as a tool for enhancing democratic governance worldwide. A number of scholars have discussed how the Internet can affect the political situation within a country (Ahmann, 1998; Godwin, 1998; Poster, 1995). From the early days of the ARPANET (Advanced Research Projects Agency Network), people envisioned the Internet's expansion to a worldwide, borderless network (Rogerson & Thomas, 1998). This global network can strengthen democracy in at least two ways: first, people can stay better informed and thus can make better choices; second, the Internet offers citizens a global forum for free expression and exchange of ideas (Perrit, 1999; Poster, 1995, 2001).

The Internet provides citizens in any country with the opportunity to stay better informed and thus learn more about options for political action and democratic governance. The information available online is rich and is difficult to censor. The sources of information are also numerous, ranging from established media corporations to independent journalists to regular citizens publishing online. People can find an enormous amount of information on any topic that interests them. Better informed citizens, arguably, can make better decisions in society and more informed political choices.

Another way in which the Internet can strengthen democracy on a global level is by offering citizens a forum for free expression and exchange of ideas with like-minded people. In most countries, people are free to go online and express their views to a global audience. They can also search for and communicate with like-minded people around the globe. Such online communication and uncensored expression reaches a large number of people and extends individual freedom. It also allows citizens to organize collective action and thus influence public policy.

It is important to note that control of the Internet by one government or corporation is unlikely. Even though regulation can limit the use of the Internet to some degree, it is quite difficult to enforce such regulation on a global scale.

### **Technological Contributions**

Furthermore, the Internet brings technological growth to a country as it can strengthen its overall telecommunications development. Maddock (1997) argues that telecommunication causes development progress in several ways. First, it leads to the creation of at least one leading sector of the economy in the country. Second, it accelerates diffusion of other technologies and thus allows faster catch-up for less

developed countries. In today's day and age, it is hardly questionable that the Internet is critical for the technological advancement of a nation and has become an indispensable part of the modern telecommunications infrastructure.

### **Social Contributions**

The Internet also brings about social change. With the advent of the Internet, we may be coming closer to what Marshall McLuhan conceived as "the global village" (McLuhan & Powers, 1989). This is another reason why it is important to research Internet diffusion. The emergence of a global community is facilitated by the Internet. People from all nationalities and various backgrounds can form communities online. Boundaries and distances between countries shrink in the virtual world. Thus, the Internet (through email, chats, and bulletin boards) brings people closer, regardless of geographic location. These online applications redefine social relationships within countries. The effect of virtual communities can increase since email remains one of the most popular Internet activities.

Winner (1997) discusses the idea that technological innovations lead to social, cultural, and political transformation. He argues that "technical innovations of any substantial extent involve a rewaving of the fabric of society, a reshaping of some of the roles, rules, and relationships that comprise our ways of living together." New technologies, then, should be studied closely and not only at one point in time. Their effect on the relationships in society should also be examined and their long-term impact followed, if we are to understand adequately the whole diffusion process and its consequences.

## Other Contributions

In addition to the benefits noted above, the global expansion of the Internet is beneficial to countries in the areas of education and health (ITU, 1999; World Bank, 2001). The Internet as an unlimited and readily accessible information resource can be useful for data retrieval on a global level (Sadowsky, 1993). It can also facilitate better service delivery and learning through distance education (World Bank, 2001).

Finally, intellectual curiosity makes it a worthwhile effort to study the expansion of the global network of networks. Press has put it well (1997):

Tracking the diffusion of the Internet is a daunting task because it is growing rapidly, is global, and expands organically, at the edges and internally, without central control. Still, business people, policy makers, and capacity planners are better off with approximate data than none at all. . . . Over the years, busy humanity has covered the globe with cities linked by railroads, highways, telephone lines, power grids, canals, and so forth, and we are now weaving digital communication links--the nervous system. I suspect that curiosity and aesthetics motivate the people tracking the global diffusion of the Internet as much as profit.

In this dissertation, the challenging task of tracking and explaining Internet adoption in a unique region of the world is pursued. The study examines Internet adoption in the countries of Eastern Europe and the former Soviet Union and analyzes the multivariate relationships to explain their levels of adoption. The dissertation proposes a five-dimensional conceptual framework to account for the differences in Internet diffusion in the post-communist countries. The study draws on research from the United States, Western Europe, and Latin America as well as cross-country Internet diffusion literature. It proposes and tests a comprehensive five-dimensional theoretical model. Based on the results, a refined conceptual framework is retrieved. Discussion shows how that refined model can be employed in predicting and modifying future Internet adoption at the country level. The rest of this chapter briefly describes the post-communist

countries and then outlines the significance of region-specific research on Internet diffusion.

### **Post-communist Countries**

The post-communist countries examined in this research include the former Soviet Union republics, Eastern Europe, and Mongolia. Specifically, they include the following 28 nations: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia (FYROM), Moldova, Mongolia, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Yugoslavia (Serbia and Montenegro). These countries represent a unique region of the world. Since the end of the Cold War they have been undergoing a transition from totalitarian regimes to democratic societies. A Freedom House report titled Nations in Transit examines the transition in the region, which is characterized by trends toward building civil society and market economy (Karatnycky et al., 1997). The report shows that the post-communist countries can be divided into three distinct groups, based on progress in these two areas (Karatnycky et al., 1997). The members of the three groups are listed below.

#### **Transition Progress**

The first group includes the leaders in the transition process: Poland, the Czech Republic, Hungary, Slovenia, Estonia, Latvia and Lithuania. These countries are classified by the Freedom House based on their 1996 survey as "liberal democracies, or polities that are well on their way to democracy, with vibrant civil societies, well-established rule of law, and market economies" (Karatnycky et al., 1997, 17). These six nations, no doubt, have made considerable progress and are leaders in the transition process in the region.

The next group of post-communist countries was classified as the intermediary group. It consists of countries that have made some progress towards the goal of building strong democratic societies, but the transition has not been as quick or smooth as in the leading countries noted above. Albania, Armenia, Bulgaria, Croatia, Georgia, Kyrgyzstan, Macedonia (FYROM), Moldova, Romania, Russia, the Slovak Republic, and Ukraine are members of the intermediary group. Bosnia and Herzegovina and Yugoslavia (Serbia and Montenegro) are also members of this group. There is considerable variation across these countries, both in terms of political development and economic progress.

The third group among the post-communist countries consists of those that have been slow to change, relative to the rest of the transition societies--Azerbaijan, Belarus, Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan. The Freedom House report posits that the first and the third group are more stable while the middle group is less stable as countries belonging to that group are more fluid and can transition to the next levels rather quickly (Karatnycky et al., 1997). However, the three groups are distinctly different from each other and are likely to remain different over time. In other words, the distinctive features of the three groups of transitional societies are stable. An interesting observation is that the countries in the three groups are clustered together geographically. Also, "the intermediate countries deserve particular attention, as their variable legacies and half-hearted reforms do not imply any clear-cut outcomes" (Karatnycky et al., 1997, 20).

Another grouping of the countries in the region is given by the United Nations Development Programme (UNDP, 1999), which uses six regional groupings in its Human

Development Report for Central and Eastern Europe and the Commonwealth of Independent States (CIS), based primarily on geographic location.

### **Geographic Regions**

The post-communist countries can be divided into 6 regions based on their geographic location: Central Europe, Eastern Europe, Caucasus, Baltic states, Western Former Soviet Union, and Central Asia.

Probably the most advanced group of countries is located in Central Europe. This group includes the following states: the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia. The second geographic group is Eastern Europe. The Eastern European countries are Bulgaria, Croatia, Macedonia (FYROM), Slovenia, Romania, and Yugoslavia (Serbia and Montenegro). The Caucasus region includes Armenia, Azerbaijan, and Georgia. All of these counties are former Soviet republics. The Baltic states have also made considerable strides in the post-Cold War transition. These states include Estonia, Latvia, and Lithuania. The Western FSU (Former Soviet Union) incorporates the following states: Belarus, Moldova, Russia, and Ukraine. Finally, Central Asia includes the republics of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

### **Economic Inequalities**

Using national income as a criterion, the post-communist countries can be divided into four groups, according to the 2000 World Development Report of the World Bank, which is based on 1998 data. The four groups are low income (less than \$760 GNP per capita), lower middle income (\$761-\$3,030), upper middle income (\$3,031-\$9,360), and high income (\$9,361 or more).

The low income countries in the region are Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Kyrgyzstan, Moldova, Mongolia, Tajikistan and Turkmenistan. The next category--lower middle income--includes the majority of the countries: Belarus, Bulgaria, Georgia, Kazakhstan, Latvia, Lithuania, Macedonia (FYROM), Romania, Russia, Ukraine, Uzbekistan, and Yugoslavia (Serbia and Montenegro). Upper middle income states are Croatia, the Czech Republic, Estonia, Hungary, Poland, and the Slovak Republic. The only high income country in the region is Slovenia (World Bank, 2000).

In conclusion, the post-communist countries have made different progress in the post-Cold War transitional period (de Melo & Gelb, 1996). Variations both in political and economic development exist (EBRD, 1997).

### **Need for Research of Internet Diffusion**

Understanding the process of Internet adoption at the county level is, first and foremost, critical for formulating public policy. National policies can contribute to accelerated Internet adoption, which can be beneficial to the country. As noted earlier, the Internet can contribute to national development in several ways. Internet adoption has a positive economic impact overall. The utility of the Internet as a political tool, which allows people to stay better informed and participate more fully in the political processes, has also been discussed. Country-specific research on Internet diffusion can also be used to enhance the technological development of the country, as outlined above. Finally, the Internet has important social functions, as it allows individuals to create online communities and interact with people around the globe, regardless of geographic boundaries. The Internet deeply impacts societies. Therefore, it is critical to better understand the process of its adoption. This will enable policy makers to exploit the Internet's full capabilities (Maherzi, 1997; Sadowsky, 1993; World Bank, 2001).

The dissertation focuses on the aggregate level of Internet adoption. Various studies in multiple disciplines have examined the topic of Internet diffusion at the individual level. Most research has been conducted in the industrialized nations. Research on Internet adoption and diffusion in the United States in particular has been quite extensive (Atkin et al., 1998; GVU, 1998; Lin, 1999; Lindstrom, 1997; NTIA, 1995, 1998, 1999; Pew, 1995; USIC, 2000) and the number of studies looking at Internet adoption and usage keeps growing.

The focus of Internet studies in general has been primarily on the United States (Daly & Miller, 1998). Literature exists also on Internet adoption by other industrialized nations, such as The Group of Eight (G-8) nations (Canada, France, Germany, Italy, Japan, Russia, United Kingdom, and United States) and OECD member countries (Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States) (Hargittai, 1999; McElhinney, 2001). Yet few studies have examined the process of Internet adoption in other countries.

As the birthplace of the global information superhighway, the United States remains one of the countries with the highest Internet penetration (ITU, 1999; Pitkow, 1996; USCD, 1998; USIC, 2000). Other developed countries (notably Scandinavian nations) are also leaders in Internet adoption. Gunarante (2001) identified three "global centers" where information technology is concentrated: NAFTA center, EU center, and Asian-Pacific center. Countries that do not belong to any of those centers are considered on the periphery of the Information Society (Gunarante, 2001).

The global distribution of Internet hosts shows that more than 88 percent of the hosts in 1999 were located in North America and Europe (ITU, 1999). The members of the European Union clearly have higher Internet penetration than the rest of the world. As Figure 1 illustrates, South Asia, North Africa, the Middle East, and sub-Saharan Africa exhibit lower levels of Internet adoption (ITU, 1999; World Bank, 2000). The countries where extensive Internet research exists tend to have higher Internet penetration. Figure 1-1 shows the unequal distribution of Internet hosts in different regions of the world.

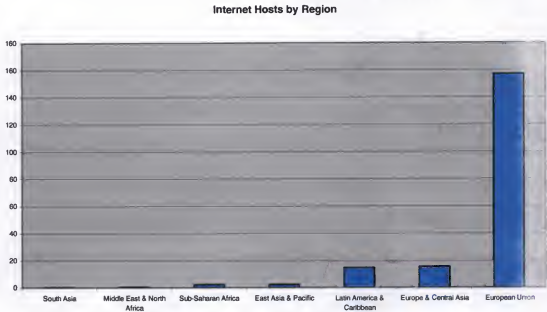


Figure 1-1. Internet hosts across world regions. Source: World Bank, 2000.

The obvious discrepancy between the industrialized countries and the rest of the world makes it not only interesting but also critical to study the determinants of Internet diffusion. It is very important to examine whether and how the “global information highway” is adopted by other countries, especially considering the possibility that the Internet not only bridges, but also widens the gap between rich and poor countries (Tele-

haves, 1996; WIPO, 2001). Furthermore, cross-cultural studies allow for identifying regional differences in the adoption of information technologies.

Studies of Internet adoption at the country level will not only provide insights about the process of Internet diffusion across countries but also show whether this process varies by certain country-level characteristics. Our understanding of Internet diffusion in non-Western countries is still very limited. As shown above, differences in levels of Internet penetration between industrialized countries and the rest of the world are quite significant. These differences cannot be fully explained by the existing literature. This dissertation extends current literature by offering insights on Internet trends in the post-communist countries.

Better understanding of how new technologies are adopted by post-communist countries can help development in those countries. Even though the direct causal relationship between Internet usage and development/economic growth has been debated, studies have shown consistently a strong positive correlation between telecommunication services and country-level economic indicators such as per capita income (Arnum & Conti, 1998; Elie, 1998; Hargittai, 1999; Singh, 1999). The process of Internet adoption remains not fully understood. It has become clear that per capita income plays an important role, but few studies have examined what other factors affect Internet adoption at the macro/societal level. This study adds to current literature as it proposes a more comprehensive model of Internet diffusion.

This dissertation focuses on Internet adoption in the former Soviet bloc. The post-communist countries are of particular interest for several reasons. First, they present a unique case study: countries that were subjected to communist rule for 40 to 70 years

give researchers a chance to follow the transition of telecommunications in post-communist societies (Katchanovski, 2000). As Rose (2002, 33) notes, "Internet access is especially important in the transition countries, because the transition process is about opening up a country to the world."

The post-communist countries share at least 40 years of Soviet influence, which makes them a different cluster for research. They share certain objective characteristics, such as high literacy rates and high educational levels (UNDP, 1999). At the same time, they differ in some cultural aspects, such as religious beliefs and historical experience (Katchanovski, 2000). The focus on one particular region of the world allows researchers to detect more intricate relationships among variables and gain insights about the magnitude of importance of country-level characteristics.

The post-communist countries present the opportunity for a case study of the Internet adoption process among a group of relatively similar countries. It is interesting to examine whether and how countries that had relatively similar technological, political, and economic levels have reached significant differences in the area of new information and communications technologies, such as the Internet. The post-communist countries can either follow the models of Internet adoption of other countries--the industrialized countries, for instance--or exhibit a different path of Internet adoption due to their unique socio-economic development. The results of the study advance knowledge of different patterns of global Internet diffusion.

Further research on Internet adoption in the region is needed because it has been identified as the next area where an Internet boom will be seen (Arnum & Conti, 1998;

ITU, 1999; USIC, 2000). This upward trend makes research on Internet adoption in the post-communist countries even more timely and important.

Table 1-1. Internet Hosts per 10,000 population in 1995 and 1999.

COUNTRY NAME	Hosts in 1995	Hosts in 1999	Increase (%)
Albania	0.11	0.24	118
Armenia	0.46	1.85	302
Azerbaijan	0.02	0.23	1,050
Belarus	0.02	0.79	3,850
Bosnia and Herzegovina	0	1.38	N/A
Bulgaria	1.26	11.9	844
Croatia	5.27	25.94	392
Czech Republic	21.16	85.59	304
Estonia	24.11	174.66	624
Georgia	0.11	1.59	1,345
Hungary	15.44	93.13	503
Kazakhstan	0.12	1.47	1,350
Kyrgyz Republic	0	4.03	N/A
Latvia	5.25	50.83	868
Lithuania	1.23	30.45	2,376
Macedonia (FYR)	0.46	4.4	857
Moldova	0.01	2.42	241
Mongolia	0	0.05	N/A
Poland	5.98	40.9	584
Romania	0.77	9.01	1,070
Russian Federation	1.48	13.09	784
Slovak Republic	5.61	38.79	591
Slovenia	28.22	99.12	251
Tajikistan	0	0.24	N/A
Turkmenistan	0	0.56	N/A
Ukraine	0.47	4.56	870
Uzbekistan	0.02	0.05	150
Yugoslavia (Serbia & Montenegro)	N/A	7.65	N/A

Source: World Bank, 2000.

Internet use in the post-communist countries has increased exponentially over the past decade (ITU, 1999; Magyar & Karvalics, 2001). Table 1-1 illustrates the growth of Internet usage in the post-communist countries by showing the increase in the number of Internet hosts. From 1995 to 1999, that number has doubled at the least. In the case of

Belarus, for example, Internet hosts increased by 3,850 percent. Lithuania, for example, had only 1.23 hosts per 10,000 in 1995, but the number increased 2,376 percent to 30.45 hosts per 10,000 in 1999. Bulgaria had a similar number of hosts in 1995--1.26 per 10,000--but the increase in 1999 was relatively small compared with Lithuania--to 11.9 hosts only. These examples illustrate that the number of Internet hosts per capita in post-communist countries remains uneven and the growth rate across countries varies widely.

Among the Central and Eastern European nations, Slovenia, the Czech Republic, Slovakia, Hungary, and Poland have higher Internet penetration than the rest of Eastern Europe. Among all post-communist countries, Slovenia and Estonia seem to exhibit higher rates of Internet adoption (CDT, 2000; ITU, 1999; World Bank, 2000). These variations in Internet penetration among countries with relatively similar socio-economic developments in the post-Cold War years suggest that there are multiple factors that affect Internet adoption on a country-level basis. The main contribution of this dissertation is to identify a group of variables that constitute the most important predictors of Internet diffusion in this particular region of the world.

### **Research Method**

The dissertation employs aggregate data to determine the multivariate relationships between Internet adoption and a number of explanatory variables.<sup>2</sup> These variables fall into five categories: economic, political, technological, cultural, and audience factors. The study design reflects the theoretical framework discussed in the literature review chapter. The dissertation employs t-test, multiple regression, and Tobit analysis to

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<sup>2</sup> The study is limited by data availability. It relies on the latest data published by various international organizations. Data paucity accounts, in part, for why Internet adoption in the post-communist countries has not been well researched so far.

determine the statistical significance of a set of explanatory variables. A more detailed explanation of the methods is provided in Chapter 4 of the dissertation.

### **Dissertation Outline**

After discussing the need for research in Chapter 1, the dissertation continues to a more detailed explanation of the significance of the Internet for the political and economic growth of society in Chapter 2. Chapter 2 also offers a brief historical overview of the major events that led to today's Internet. Next, Chapter 3 reviews relevant literature and explains how it is related to the present study. Chapter 3 also describes the comprehensive five-dimensional theoretical model proposed and tested in the dissertation. Chapter 4 explains the methods used and describes the study design, data collection, operational definitions, and scales of measurement. The statistical results are analyzed next in Chapter 5. The discussion of the results follows in Chapter 6. Chapter 7 summarizes the entire dissertation. It also addresses broader implications and limitations of the study. Suggestions for future research and theoretical and practical consequences also are offered.

## CHAPTER 2 INTERNET AND SOCIETY

The Internet's contributions to society are manifold. The Internet is especially important for the political and economic development of nations. The first section of this chapter presents an overview of Internet development and growth from the 1960s until today. A timeline including Internet milestones is provided. After outlining briefly the history of the Internet, the chapter describes the importance of the Internet for society as it relates to two major issues: the political process and economic development.

### **Development of the Internet**

Even though the concepts underlying today's Internet were created in the late 1960s, the Internet diffusion on a global level occurred only in the 1990s. Several key developments that led to the current state of the Internet are presented below.

### **The Invention of the Internet**

The Internet was created in the 1960s as a result of close collaboration within the American research community (Hafner & Lyon, 1996). Tracing the history of today's Internet, it is important to note that four significant aspects of the network were considered from the start: technological, management, social, and commercial (Leiner et al., 1997).

The first documented idea of an Internet was discussed in internal memos by J. C. R. Licklider at the Massachusetts Institute of Technology (MIT). Licklider described his idea of a "galactic network" in these memos in 1962 (Leiner et al., 1997). Other developments such as the first work on packet switching theory took place during the

early 1960s as well (Hafner & Lyon, 1996). The Advanced Research Projects Agency (ARPA), a research and development organization funded by the U.S. Department of Defense, began operating in 1967.

ARPA was instrumental in the development of the early Internet. ARPA tested data transfer across telephone circuits using packet-switching and thus became the first agency to implement a network based on that technology (Leiner et al., 1997). This network was named Advanced Research Projects Agency Network--or ARPANET--and became the forerunner of the Internet (Hafner & Lyon, 1996).

Robert Taylor at ARPA found funding to test this so-called "network experiment" beginning with a few nodes (Hafner & Lyon, 1996). The first two computers linked on the ARPANET were at the Network Measurement Center at the University of California at Los Angeles (UCLA) and the Stanford Research Institute (SRI) at Stanford University. The exchange of the first host-to-host message took place on that network in 1969. Soon after that, two more nodes were added: the University of California at Santa Barbara (UCSB) and the University of Utah. Thus, four host computers were connected by the end of 1969 into the initial ARPANET (Leiner et al., 1997). These four nodes were the first realization of the idea of the "galactic network." Today it is common to refer to the 1969 ARPANET as the earliest existing Internet (Hafner & Lyon, 1996).

From the beginning, the Internet was conceived as a general infrastructure that would connect multiple independent networks and support numerous and new applications. It is considered an open-architecture network--a network of interconnected, independent computers. The structure of the Internet was "foretold" by Paul Baran, an engineer at the RAND corporation (Hafner & Lyon, 1996). He created the idea of a

distributed network, a digital switching technology to connect computers at various locations. Baran also came up with the idea to break down the message into small pieces (packets) that will travel independently over a network and then reconnect before arriving at their final destination. This is still how messages are sent on the Internet.

A major step toward developing today's Internet was the creation of TCP/IP (Transmission Control Protocol/Internet Protocol). This protocol meets the needs of an open-architecture network environment. It was compiled in 1972 by Robert Kahn at DARPA and Vinton Cerf at Stanford University (Leiner et al., 1997). Basically, the TCP/IP protocol allows information bits to travel to destinations independently. The Internet Protocol (IP) is responsible for addressing and forwarding of individual packets while the Transmission Control Protocol (TCP) is responsible for service features such as flow control and recovery from lost packets.

It is important to note that the researchers at ARPA, its contractors, and several universities collaborated closely to create, test, and improve the Internet invention (Hafner & Lyon, 1996; Leiner et al., 1997). In the post-Sputnik era, money for research from the U.S. government became abundant. As Hafner and Lyon (1996, 23) note, science was "the New Frontier." The initial collaboration between the academic research community and ARPA, an agency within the Defense Department, led to the successful implementation of the ARPANET (Hafner & Lyon, 1996). Therefore, the Internet represents a good example of "the benefits of sustained investment and commitment to research" (Leiner et al., 1997). A number of people contributed to the development and improvement of the initial Internet, but the original research and implementation happened mostly under ARPA's funding umbrella in the 1960s (Hafner & Lyon, 1996).

Below, some milestones in Internet development are shown.

- 1962--Primary idea of galactic network
- 1967--ARPANET development begins
- 1969--First four host computers connected over the ARPANET
- 1972--TCP/IP implemented
- 1972--First public demonstration of ARPANET
- 1972--First email application created at BBN
- 1973--First international connections to ARPANET created in England and Norway
- 1974--First use of the term "Internet" in a conference paper by Cerf and Kahn
- 1978--Trials for a private system, Telset, begin in Finland
- 1983--Domain Name System developed at the University of Wisconsin
- 1986--NSFNET replaces the ARPANET
- 1989--World Wide Web invented
- 1993--Mosaic, the first Web browser for personal computers is created

Figure 2-1. Internet timeline.

### **Internet Growth and Global Expansion**

The previous section shows that initially the Internet was nothing more than a network to be used internally within a particular agency. Access to that network was limited to a handful of people and information about it was sparse. The first public demonstration of the network happened only in 1972. Even at that time, however, people envisioned its expansion to a worldwide, borderless network (Rogerson & Thomas, 1998). This was not yet technically possible though. The Web browser--the graphical interface of the World Wide Web--was created in 1993. The first graphical browser Mosaic was the precursor of Netscape and later Internet Explorer. It encouraged faster diffusion of the Internet around

the world (Winston, 1998). Figure 2-2 shows the growth of Internet hosts over the years on a global scale.

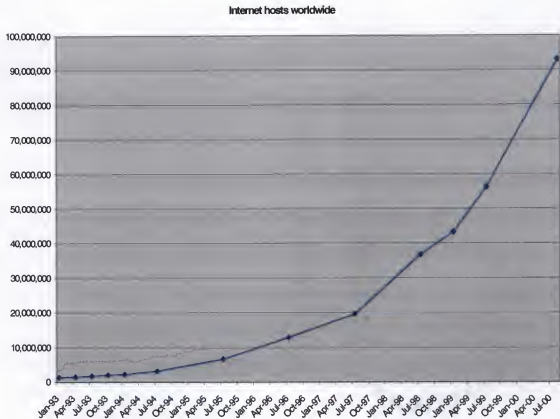


Figure 2-2. Total number of Internet hosts. Source: Internet Software Consortium, 2000.

Clearly, the use of the Internet increased dramatically after the free distribution of the Web browser. The World Wide Web was developed by Tim Berners-Lee at CERN in Switzerland. The World Wide Web (WWW) uses HTML (hypertext markup language), which incorporates text and graphical elements as well as hyperlinks. The introduction of the World Wide Web made it easy for non-technical persons to use the computer network. As the inventor of the World Wide Web acknowledged, “transferring information was too much of a hassle for a non-computer expert” before that (Berners-Lee, 1999, 18). Berners-Lee’s goal was not only to make it easier to use the Internet, but

also to create a system in which different computers with different software could connect and “talk” to each other and thus enable researchers to share their work quickly and easily. Berners-Lee’s first formal proposal for funding was submitted in March 1989 at CERN, but received no feedback. Another proposal followed with the same result. As Berners-Lee wrote (1999, 27), “explaining the vision of the Web to people was exceedingly difficult.”

Finally, the World Wide Web was released in 1993. Like the Internet on which it runs, the Web has no central location as the online information is distributed: i.e., documents are stored on many computers all over the world. The Internet has no main node, so it has an infinite storage capacity as a result.

The global growth of the Internet has been impressive and often labeled “revolutionary” and “phenomenal.” In fact, it has been argued that the Internet is the fastest growing communications technology ever (WIPO, 2001). In 1990, only 22 countries were connected to the Internet, compared to 226 countries in 1999. The number of countries connected to the global network increased tenfold in less than 10 years. As of September 2002, there are 605.60 million online users worldwide (Nua, 2002).

Even though the global expansion of the Internet has been accelerating, disparities between regions and countries do exist. The United States and North Western Europe have the lion’s share of the Internet (ITU, 2000). The Internet is expected to become less U.S.-centric though. Forecasts show that Internet growth in the United States will level off by 2002, and most continuing growth will be observed in Western Europe and developed Asia (Bieler & Stevenson, 1998).

In the Asia-Pacific region, Australia, Japan, and New Zealand are clearly the leaders in Internet adoption. Hong Kong, Singapore, South Korea, Taiwan, and China also exemplify fast Internet growth rates (USIC, 2000). The rest of the region and South Asian countries in particular lag behind in Internet usage. Japan is expected to continue dominating the Asian Internet market (Bieler & Stevenson, 1998).

In Europe, there are disparities in Internet penetration across East-West and North-South lines. Internet penetration rates in Sweden, Norway, Denmark, and Finland surpassed 35 percent in 1999 (USIC, 2000). Italy, France, and Spain had relatively lower Internet use compared with the Northern European and Scandinavian nations. With the exception of Slovenia, the countries of Eastern Europe are further behind. Analysts forecast, however, that Eastern Europe and the former Soviet Union are likely to exhibit high Internet growth rates (Bieler & Stevenson, 1998; ITU, 1999).

Projections show that together with Eastern Europe, Latin America will be one of the regions to experience substantial increase in Internet usage (USIC, 2000). Internet adoption in Latin America and the Caribbean is growing steadily. Brazil, for instance, has one of the fastest growing ICT markets in the world (World Bank, 2001). Mexico and Argentina, in addition to Brazil, are leaders in Internet usage in the Latin American region.

In Africa, Internet growth rates have been relatively low. According to 2000 data, there were 1.5 million Internet users in Africa (USIC, 2000). About 1 million of those--or two-thirds of all Internet users, however, were located in South Africa (USIC, 2000). In the summer of 2000, more than 300 million people worldwide were using the Internet regularly (USIC, 2000). Yet only 0.6 percent of the people living in developing countries

had access to the Internet (USIC, 2000). As a recent report from the Center for Technology and Democracy (2000) notes, Internet disparities bring a danger of dividing the countries in the world into "information rich" and "information poor."

The Internet is constantly evolving and expanding. It is hard to control the Web, both in terms of access and content, unlike other media (Perrit, 1999). Regulation has been formulated within different countries, including China, Singapore, and Turkey, to try to limit freedom of expression and censor the Internet (Cortez, 2000). Legislation to restrict Internet in some way (by censoring online information, licensing Internet providers, etc.) has been proposed in Australia, Chile, Great Britain, and South Africa (Cortez, 2000). In China, for example, cyber cafés must obtain a license from the state and ISPs are required to "register their customers with the authorities" (Cortez, 2000). In addition, Web sites containing subversive information are blocked. However, it is generally hard to implement Internet regulation due to the global and changing nature of the network (Perrit, 1999).

The World Wide Web and the Internet as a whole offer unique opportunities for nations, both in terms of political and economic development. These opportunities are discussed next.

### **Internet and Political Development**

A number of studies have discussed the potential of the Internet to enhance democratic governance. Ahmann (1998), for instance, looked at how the Internet can increase political participation in South Africa. She found that political information online is abundant and that the Internet can easily be used for political education within a country (Ahmann, 1998).

The Internet, then, can strengthen the democratic process by serving as a vehicle for political education of citizens. This is achieved not only by keeping the citizens better informed (with access to various sources and media online), but also by providing a public forum for communication and exchange of information with other like-minded people. Thus the Internet can serve as a channel for mediated interpersonal communication and community formation.

Interestingly, in the early 1960s J.C.R. Licklider, one of the key figures in the invention of the Internet, conceived it as a network that would, indeed, allow citizens to participate in the political process more actively. He envisioned people on the global network attending a "giant teleconference" (Hafner & Lyon, 1996, 34).

Perrit (1999) discusses the role the Internet can play in strengthening both national and global governance. He sees the potential of the Internet in four specific areas, all of which lead to strengthening international cooperation. Perrit (1999) argues that the Internet can strengthen international law and can also empower and improve local non-governmental organizations (NGOs). The Internet has the potential to support the international security system. Finally, the Internet can strengthen the economic interdependence between countries (Perrit, 1999).

### **Democracy and the Internet**

Many scholars at different times in history have tried to define what democracy means. There is no single clear-cut definition that encompasses all characteristics of democracy. The meaning of democracy varies with time and place. The 2000 political crisis in Yugoslavia shows the significance of one aspect of a democratic society--free and fair elections. When the Serbian people realized that Slobodan Milosevic was trying

to manipulate election results, they took to the streets because the mandate of their vote was not acknowledged.

In addition to free elections, people in a democracy require freedom of expression. This is also supported by a Serbian example, which speaks to the fact that the nature of the Internet makes it hard to control. Slobodan Milosevic tried to censor print and broadcast media during the 1999 Kosovo crisis. Milosevic's government also tried to suppress media freedom by shutting down those media that supported government opposition. After being closed down, a popular opposition radio station--Radio B92--used the Internet to "broadcast" to the outside world. Thus, the Serbian opposition was able to distribute news and information that was censored by other media. This clearly speaks to the democratic potential of the Internet. During the Serbian crisis, this new medium provided one of the few channels for pro-democratic groups in the country to speak to the outside world while other domestic media were strictly censored by the Serbian government. As Perrit (1999) notes, "the decentralized nature of the Internet itself . . . makes it very difficult for . . . governments to control and censure political thought, speech, and action."

An attempted legislation in the United States also clearly shows the value of a free Internet. The proposed Communication Decency Act, which was not accepted by the U.S. Congress, shows that freedom of expression is highly valued (Cortez, 2000). The *Reno vs. ACLU* lawsuit exemplifies the value of freedom of expression embedded in the American constitution. As Cortez (2000) notes, the following international treaties also recognize freedom of expression as a basic human right: the Universal Declaration of Human Rights of 1948, the Pact of Civil and Political Rights of 1966, and the Pact of

Economic, Social, and Cultural Rights of 1966. By extension, all countries that are signatories of these international treaties have to harmonize their national legislation with the provisions of the treaties (Cortez, 2000).

The Internet has served as a vehicle for communication for anti-government groups worldwide. In China, Lin Hai was given a two-year sentence for sending email addresses to an anti-government publication (Cortez, 2000). The Internet provides an outlet both for reaching other anti-government activists directly and for publishing relevant information. In the case of Malaysia, the Internet allowed the political opposition that was living on a remote island to use email to organize anti-government action.

Diversity of opinions is critical for a well-functioning democracy. The more voices are expressed in a public forum, the better. The value of having more information available from more sources than before, expressed in a public forum, can hardly be disputed--it makes democracy stronger (Held, 1995).

The Internet certainly makes it easier to get more information from more sources than ever before and provides a unique opportunity to communicate online, despite geographic distances. Perrit (1999) says: "The ease with which people can participate in cyberspace activities enabled the Internet to grow exponentially with virtually no governmental oversight. This growth has created a cyber-culture that celebrates freedom and distrusts traditional political institutions trying to come to grips with the implications of this profound electronic revolution in information technology."

Poster (2001) discussed Habermas's idea of the public sphere--a "space" where citizens deliberate and interact to form public opinion--as it relates to the Internet. Jakubowicz says that the "public sphere is a forum of public debate where citizens can

debate issues of common concern, voice and act on their views and seek to arrive at a consensus on matters of general interest" (Jakubowicz, 1998, 12). Gaynor (1996) argues that it is difficult to see if the Internet enhances or fragments the public sphere in a democracy. Because it offers citizens a venue for expressing public concerns, it does, indeed, serve as a part of the public sphere. Thus, the Internet enables individuals to influence public policy through the pressure of public opinion.

Sen (1999a, 10) argues that a democracy requires "the guaranteeing of free discussion and uncensored distribution of news and fair comment." The importance of a free press and informed citizenry is discussed next.

### **Free Press and the Internet**

The Internet affects media organizations around the world. The structure of the Internet makes national boundaries irrelevant to the distribution of media messages. The Internet also allows people to speak publicly and publish information, just like the traditional press in the past. Online media, however, reach wider, global audiences (Perrit, 1999). Thus, citizens can access various sources and free media over the Internet.

Today we seem to take for granted that a free press is a vital part of any democratic society (Jakubowicz, 1998). But what specific functions do the media perform in a true democracy? According to McChesney (1999), the press has a responsibility to perform a public service. A free press, he adds, should encourage diversity of opinions. A democratic society presupposes pluralism, i.e. the expression of different opinions. Under Communism, people living in the so-called Soviet-bloc countries not only couldn't express their opinions freely, but they even felt the pressure to say "the right thing," even if it wasn't what they believed (Yakovlev, 1989). The state prevented the existence of a free press by enforcing strict censorship and also having financial control of all media.

The Communist Party also jammed foreign media that broadcast within the Soviet bloc to prevent diverse viewpoints from reaching the average citizen. The official press was simply a mouthpiece of the communist government.

In a democratic society, however, the press should not be a mouthpiece of the ruling party. On the contrary--it should hold the government accountable for its actions. The press is said to have a watchdog function--to hold the government accountable for its actions. The media in a democracy should serve the public by ensuring that the government is not abusing its powers. A free press in a democratic society is a place where deliberation should happen, according to Nader (Nader, 1998). The press, he argues, should enliven public debate and engage people into it. Such lively press functions as part of the so-called public sphere. The public sphere, as mentioned above, enables individuals to give their input through public debate, which is necessary for a healthy democracy. If the Internet acts as a space for public debate, then it can empower citizens globally.

Another important basic function of a free press is to keep citizens informed. It has been argued that citizens on a global level can stay better informed through the Internet. Thus, citizens can participate better in the democratic process in any country (Sen, 1999b). Sen says that "guaranteeing of open discussion, debate, criticism, and dissent, are central to the process of generating informed and considered choices" (Sen, 1999a, 9). This is even more important to people in the post-communist countries who, as mentioned above, were not allowed to openly state their opinions and engage in free discussion prior to 1989.

Traditionally, the media have served as gatekeepers in society. They filtered the information and chose which facts were newsworthy. The media thus used to serve an important agenda-setting function: they told the public what issues were important. It has been argued that the gatekeeper role and the agenda-setting role of the traditional press can be manipulated by governments. The Internet may remove the possibility for such direct controls. Internet news are not easy to control, as the gatekeeping and the agenda-setting role can be assumed by the average person.

The Internet transcends national boundaries and withstands governmental controls. The Internet also allows people to speak publicly and publish information, just like the traditional press in the past by reaching wider, global audiences (Perrit, 1999). Thus, both functions are enhanced: (1) citizens can stay better informed (with access to various sources and free media over the Internet) and (2) citizens can use the Internet as an avenue for communication and debate in a public forum. This suggests the potential of the Internet to affect the political process both nationally and internationally, and to shift the practice of democracy to more active citizenry.

In addition to political development, the Internet also affects economic development worldwide. The rest of the chapter outlines the most important economic impacts at the national level.

### **Internet and Economic Development**

There are at least four aspects of the Internet that directly affect developing countries. First, the Internet has enabled cheaper production and distribution of goods. Second, the emerging Internet economy has played an important role in reforming traditional economic structures within countries. Third, the Internet has expanded and strengthened global markets by enabling more exports and imports between countries.

Finally, it has been argued that the Internet has "leapfrogging" potential for less developed countries.

### **Lower Production and Distribution Costs**

The 20<sup>th</sup> century has witnessed a tremendous growth of technology. One of the important effects that technology innovations have brought about is the reduced cost of production (Christensen, 1997; Sadowsky, 1993; The new economy, 2000). Not everybody agrees that reduced production costs or optimized efficiency is generally good for society, but still the cost of information exchange today is much lower compared to the time when computers first started (The new economy, 2000). This is true for other services as well.

Sadowsky (1993) discusses several ways in which communication technology affects economic development in society. He contends that the transportation industry as well as the finance sector would be very different without the use of high-speed communication and computing technology. Decrease in the price of microelectronics, satellite technology, fiber optics, and packet-switching, Sadowsky (1993) argues, have in turn accelerated the adoption of modern computing.

Information technology (IT) has been a major factor in the increased production of goods and services by U.S. workers (Barua et al., 1999). IT has also made these workers more efficient. Of the 2.6 percent increase in U.S. labor productivity between 1996 and 1999, more than half was directly related to the information technology sector (USIC, 2000).

The Internet intensifies price competition among producers and their suppliers, and thus leads to lower prices for consumers as well (DePrince & Ford, 1999; Guthrie & Austin, 1996). Guthrie and Austin (1996) contend that product quality is improved as a

result. DePrince & Ford (1999) argue that labor productivity is increased by Internet marketing while searching and transaction costs tend to drop. They predict that “as the I-ECON’s share of the total economy rises, the magnitude of the Internet’s macroeconomic impact will also rise” (DePrince & Ford, 1999).

### **The Internet Economy**

The economic impact of the emerging Internet economy is also impressive. DePrince & Ford (1999) note that the Internet economy has been affecting the following areas: hardware, software, intermediaries (such as travel and auction companies), and e-commerce. All these sectors have been transformed, directly or indirectly, by the advent of the Internet (McKnight & Bailey, 1997).

DePrince & Ford (1999) note that there is a shift from traditional distribution methods to Internet distribution of specific products and services. They distinguish between two types of Internet distribution: “Amazonic” and “Dellphic.” The former refers to ordering products online from a company, such as Amazon.com, that maintains a warehouse of its products. Such transactions can be either public or private, individual or wholesale. The second distribution method, named after Dell computers, is the ordering of a product before it has been manufactured. Users make an order; then the producer creates the product or service and ships it to the consumer/buyer. In this case, the customer usually responds to promotional efforts by the producer. Both of these distribution channels have become popular and are affecting the overall economic structure within and between countries.

The Internet has been seen as a driver of economic boom. The Internet economy workforce in the United States grew 36 percent from 1998 to 1999 (Barua et al., 1999). According to the U.S. Commerce Department, out of a 5 percent improvement in U.S.

production of goods and services in 1999, 1.6 percent has been attributed to information technology (IT) use (Barua et al., 1999). Labor productivity in the United States increased by roughly 3 percent a year from 1995 to 2001; faster growth was observed in IT-using industries (Baily, 2001). In other words, studies have shown that IT improves or at least contributes to economic productivity.

The Internet facilitates electronic transactions. Even though electronic commerce is not a new phenomenon in itself, the speed of growth has been accelerated by the Internet (Atkinson & Court, 1998; Dryden, 1998; WIPO, 2001). Online commerce (e-commerce) is expected to comprise 4.4 percent of the U.S. Gross Domestic Product (GDP) by 2002 (WIPO, 2001). Its growth globally has also been impressive (World Bank, 2001; WIPO, 2001).

As Baily (2001) notes, "new technologies are altering the way traditional industries operate." The Internet has also strongly affected the following areas: financial services, travel agents, stock trading, computer sales, music CDs, software, and book sales. Some other types of businesses are likely to be affected by the growing Internet economy as well. E-bay is one example where the role of the intermediary is eliminated. Other intermediaries such as stock brokers may disappear as well.

Of course, as DePrince and Ford (1999) point out, not all products and services will be affected by the Internet economy. They also note that the Internet has a tremendous impact not only on the micro, but also on the macroeconomic level, as it promotes improved macroeconomic performance (DePrince & Ford, 1999).

### **Global Markets**

The Dellphic and Amazonic distribution channels described above also work in a global setting. Business-to-business transactions and international trade are facilitated by

the Internet. DePrince and Ford (1999) conclude that "the emergence of the Internet economy . . . may well rival the introduction of printing, steam power, the telephone, and the assembly line as a growth-enhancing innovation."

Electronic communications facilitate international commerce (Bauer, 1994). The Internet introduces new mechanisms for imports, exports, and trade in general (World Bank, 2000, 2001). As a global channel, it makes the actual transactions easier and faster. One type of product that illustrates well the ease of online transactions is information. It is very easy to buy, sell, or transfer data over the Internet. Information transactions exhibit economies of scale. The more copies of a data set, for instance, are sold, the higher the profit margins. Producing an additional copy of the same data set is virtually at no cost.

### **Leapfrogging**

The argument exists that developing countries can "leapfrog" as they adopt new technologies and thus surpass developed countries. Basically, leapfrogging is the ability of countries that are technologically behind suddenly to skip generations of intermediate technology and adopt the latest one. This is seen as economically beneficial to countries (Singh, 1999). For example, a nation with very low telephone penetration may adopt the latest technology for mobile phones and thus jump ahead of other states. Such technology is likely to be cheaper, more efficient, and easier to build. Government policy in developing countries has been identified as the main barrier to leapfrogging (The new economy, 2000).

The term leapfrogging has been used in the literature in two other ways, in addition to skipping an intermediate technological stage. Singh (1999) argues that the term "leapfrogging development" has been used to imply that developing countries can skip

stages of development as a results of telecommunications and thus become members of the postindustrial society. The third way in which leapfrogging has been used is to mean that telecommunications can itself lead to accelerated development in such countries (Singh, 1999). Even though this doesn't happen automatically, the possibility exists at least that adopting latest information and communications technologies (ICTs) and sophisticated Internet infrastructure will lead to positive economic impact within countries.

Finally, the tremendous impact of the Internet needs to be put into perspective. All the possible positive changes will not happen automatically (IMF, 2000b; World Bank, 2001). Sale (1999) discusses the negative effects of large displacement of human labor by the introduction of more sophisticated industrial technologies, such as the Internet. Solomon (1998) warns us about the possibility of the Internet becoming an electronic mall. Winner (1997) raises questions about the concentration of wealth and power "around" new technologies such as the Internet. Another potential drawback of Internet use is that the Internet allows dominant ideology transfer and consumer life-styles to other countries. The Internet can also widen the gap between developing and developed countries. That is one reason for concerns about the uneven Internet diffusion on a global level. Despite these potential setbacks, it was argued above that the Internet opens doors to improving democratic governance and economic development of nations worldwide.

## CHAPTER 3

### LITERATURE REVIEW

This chapter first discusses the diffusion of innovations theory. It provides an overview of its generalizations and establishes how these generalizations apply to the Internet. Several different issues that help in understanding Internet adoption from a diffusion of innovations perspective are identified. Next, the chapter reviews the body of literature on new media technologies adoption and use. The chapter concludes by identifying what major factors affect Internet adoption at the country level. A comprehensive five-dimensional analytical framework is proposed. Finally, potential interactions between diffusion of innovations and new media technologies research are discussed.

#### **Diffusion of Innovations**

One way to study the Internet is by using traditional diffusion studies. This is not an easy task, however. Classification of the Internet as an innovation is difficult because of its very complex nature. In addition, the diffusion process at the societal level is not fully understood. Rogers (1995, 5) defined the diffusion of an innovation as "the process by which an innovation is communicated through certain channels over time among the members of a social system." An innovation can be an idea, product, value or a new technology. Diffusion of innovations typology is applied below to one of the fastest growing new technologies--the Internet.

### Basic Generalizations

Diffusion of innovations is one of the most popular social science theories and it has been used in variety of academic disciplines (e.g., anthropology, sociology, communications, marketing, geography, education and health). It started in the early 1900s with the writings of Gabriel Tarde, a French philosopher, who described many of the components of adoption and diffusion in his work The Laws of Imitation (Tarde, 1903). The first systematic diffusion study, however, was conducted at the University of Iowa in 1943. In their seminal work, Ryan and Gross (1943) examined the adoption of hybrid seed corn by Iowa farmers. Diffusion research has grown considerably since then.

Diffusion of innovations offers a linear model for the diffusion process, mostly focusing on the individual level of adoption (Rogers, 1995). It posits that innovations are typically diffused after going through the following stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation (the actual adoption of the innovation), and (5) confirmation stage. The first two stages in this process resemble a communication model in which a sender has to get a message across to a receiver. The mass media are very important at the knowledge stage (but not as important at the persuasion stage) to get the information out that a new product or technology exists to fulfill a particular need (Rogers, 1995).<sup>1</sup>

Diffusion of innovations posits that innovations in general follow an S-curve of adoption over time. In other words, the first stages of adoption are slower, then we have a faster increase in the number of adopters (resulting in a steeper slope of the adoption

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<sup>1</sup> At the knowledge level of adoption, we can distinguish three different levels of knowledge: awareness knowledge, how-to knowledge, and principles knowledge.

curve), and finally the curve levels off at the later stages. Empirical data for various technology adoptions support the S-curve typology (Severin & Tankard, 1997).

### **Technology Innovation Attributes**

Everett Rogers, one of the most influential diffusion scholars (Severin & Tankard, 1997), identified five attributes that play a role in whether a particular innovation is adopted or rejected (Rogers, 1995). They are: (1) relative advantage; (2) compatibility; (3) complexity; (4) trialability; and (5) observability of the new idea, product or technology. Rogers later added reinvention as the sixth additional attribute. Reinvention refers to cases where an existing technology is used for a different purpose than originally conceived. For example, if we first thought that the computer was supposed to be used for word-processing, we reinvented its use when we started sending e-cards. Rogers (1995) contends that 48 to 87 percent of the variability of adoption is explained by the perceived attributes of an innovation.

The first attribute--relative advantage--refers to the question whether the innovation is better than what one used before. The perceived relative advantage of the Internet, at least at first, will be largely dependent on the marketing and promotion efforts put into mass media campaigns. Compatibility is whether the innovation is compatible with previous technologies. The next attribute, complexity, refers to the question how difficult it is to use the innovation. If it is more complex, people will be less likely to use the innovation. Trialability is whether a person can try out the innovation. Finally, observability is whether the results of the innovation are readily observable. Clearly there are extraneous factors "outside" of the individual that will affect these attributes.

### **Interactive Innovations**

Interactive innovations are innovations that depend on the number of people who have already adopted a particular innovation (Mahler & Rogers, 1999). In other words, the value of the innovation—its relative advantage in the mind of the potential adopter—increases if there is a large number of people who are already using that innovation. In the case of the Internet, people may be more likely to adopt it if they have the ability to be connected to more people who are using the Internet already. A good example to clarify this point is email—if your friends have email already, then you can communicate with them over the Internet. The perceived value of the technology increases as a result.

Several technological innovations have been labeled interactive in nature. Previous research, however, has not clearly distinguished between interactive and non-interactive innovations (Mahler & Rogers, 1999). The classic example of the fax machine shows that if only very few people are using the innovation, its value is relatively low. Once there is a large number of others that use the fax machine, its diffusion increases very fast.

Mahler and Rogers (1999) examine the diffusion of interactive communication innovations (several telecommunications services) and their adoption by German banks. They argue that the rate of adoption of such interactive innovations follows a modified S-curve (Mahler & Rogers, 1999). The adoption process of interactive innovations such as the Internet begins with a slower rate of adoption, but then has a more “pronounced” critical mass effect; once the critical mass is reached, the innovation takes off more rapidly than projected by the traditional S-curve (Rogers, 1995; Mahler & Rogers, 1999;

Garrison, 2000). In other words, the adoption of interactive innovations follows a modified S-curve.

The importance of the (perceived) number of other adopters of the interactive technology decreases over time. Today fax machines and telephones are so widespread (at least in the United States) that potential adopters don't have to consider the interactive nature of these communication technologies. As Mahler and Rogers (1999, 720) point out about telephone adoption today, "the utility of adopting depends almost entirely on factors internal to the individual, rather than on such externalities as the perceived proportion of others with whom the individual wishes to communicate by telephone." The Internet in the United States has probably reached that point. If we study Internet adoption in a developing country, however, network externalities are likely to affect the Internet diffusion process (Maherzi, 1997).

Network externalities are often cited as attributes of information goods and services. Basically, network externalities add value to a certain product or service with the increase in the number of its users. Shapiro and Varian (1999) discuss in economic terms how information goods have higher network externalities and thus are more valuable to both the user and the provider. In the case of the Internet--the so-called global network of networks, externalities stemming from the number of others who have already adopted it should be highly visible. As the Internet becomes more and more prevalent, and especially after a critical mass is reached, the significance of the total number of users will fade away.

Network externalities can be direct or indirect. As Mahler and Rogers (1999) note, there were indirect network externalities in the case of the VCR diffusion. Two different

standards were developed--Beta and VHS; tapes dubbed in one of these standards couldn't be played on the other. Yet the VCR standard that was adopted was VHS, even though it was the technologically-inferior one (this was largely due to better marketing efforts on the part of VHS). In the VCR case, critical mass had to be reached for each of the two standards (Mahler & Rogers, 1999). This example is applicable to Internet adoption, and especially to the adoption of specific Internet software. The diffusion of online chat programs such as ICQ will depend largely on the ICQ company's efforts to make their program the standard in online chatting.

### **Cluster Innovations**

One way to study the Internet using traditional diffusion studies is by positioning it as an interactive innovation. Another approach is to examine it as a cluster innovation. Prescott and Slyke (1997) argue that the Internet can be best understood as a cluster innovation because of its many components. Clearly, classification of the Internet as an innovation is hard because of its very complex nature. As Prescott and Slyke (1997) suggested, a good way to understand the Internet may be by positioning it as a technology cluster innovation--i.e., not as one single technology, but as several technologies working with one another. The Internet has many components, many of which are related to or dependent on each other. If people adopt email technology, they are more likely to adopt Instant Messenger, for example. They will not be able to do this, however, unless they have the Internet Explorer browser installed already.

If we see the Internet as a cluster innovation (several technologies working together), we see that it has many relative advantages, depending on which purpose you use it for. The Internet is not compatible with anything that existed prior to it, its networked structure and way of condensing space and time have been unprecedented.

The only other technological innovation in history that had such dramatic effect was probably the telegraph--“shrinking the world faster and further than ever before” (Standage, 1999, vii).

Both cluster innovations and interactive innovations will have different degrees of complexity, trialability and observability. The Internet today may be easier to try out compared to five years ago. Any American can go to the public library or to a friend’s house, for example, and try using the Internet or any of its components and/or services. Its results are also readily observable. In general, that should contribute to a faster rate of Internet adoption.

When we talk about the diffusion of an innovation, we basically examine behavior change over time. In this case, we are interested in how many people have adopted the new technology within a country. Thus we are interested in measuring the number of adopters who have reached the implementation stage in the adoption process. It will be useful to review next what type of adopter categories exist in diffusion literature.

### **Types of Adopters**

There are five basic adopter categories described in diffusion of innovations studies on the basis of how fast a member of the social system adopts a new idea, product or technology. They are: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards (Rogers, 1995). Diffusion of innovations posits that innovators are venturesome, cosmopolite, with higher income and technical knowledge (Rogers, 1986; Rogers, 1995). The innovators account for 2.5 percent of the total population that in the end adopts the innovation. Typically, the early adopters are about 13.5 percent, the early majority and the late majority groups are 34 percent of the population each, and the

laggards account for 16 percent (Rogers, 1995). This reflects the S-curve adoption process and follows from the normal distribution of the total number of new technology adopters.

Using Rogers' normal distribution curve of innovators, early adopters, early majority, late majority, and laggards, it is easy to predict in which category future Internet adopters will fall. This is a useful technique when examining adoption at the national level.

### **Internet User Profile**

An increasing number of research studies have been conducted in the United States to discover the "profile" of Internet users. A number of user studies conducted by the Georgia Tech GVU lab in the past years show that most Internet users in the United States are male, well educated, and upper income (GVU, 1999). In a study of American students Stewart et al. (1998) conclude that, in general, men are more willing to adopt a new technology than women. Interestingly, they also suggest that whites are more willing to adopt than other cultural groups in the United States.

Lindstrom (1997) finds similar characteristics for North American Internet users: they are mostly male, upper class and well educated. Lindstrom's survey looks at users in the United States and in Canada during two time periods. The second survey shows that the typical user has changed and that the user base has broadened (Lindstrom, 1997). The typical Internet user in the United States has changed. More women and older people have joined the online community. In fact, more recent statistics show that the majority of American Internet users are women (Nielsen NetRatings, 2000). This remained true in 2002 (Nielsen NetRatings, 2002).

What is the Internet user profile in other countries? Research on Internet use in Chile, for example, shows some similarities: Internet users in the city of Santiago resemble closely early American users (Mendoza & Alvarez de Toledo, 1997). The typical Chilean Internet user can be characterized as young, male, and highly educated. The study also reveals that Chilean users tend to have higher income level and to connect to the Internet from work or from educational institutions (Mendoza & Alvarez de Toledo, 1997).

One of the few studies on Internet users in Eastern Europe shows a similar typology (Dimitrova, 2002). Dimitrova's survey of Bulgarian Internet users finds that the majority are highly educated and male (Dimitrova, 2002). Her questionnaire does not include income level questions. Similarities in user characteristics are also found in Asian countries. The typical Internet user in China, for instance, is also more educated, young, and mostly male (Jisi et al., 2001). In addition to the United States, Canada is the only other country where the number of female Internet users has surpassed that of male users (Nielsen NetRatings, 2002).

Many studies have tried to explain why some people have adopted the Internet while others have not (Goode & Stevens, 2000). Atkin, Jeffres, and Neuendorf (1998) examine what differences exist between Internet adopters and non-adopters, and whether those individual characteristics can be used to predict the potential users of Internet technology. Atkin, Jeffres, and Neuendorf (1998) draw from several theoretical frameworks. They see the computer as one of the most discontinuous innovations ever. They include media usage variables when looking at what characteristics differentiate early Internet adopters from late adopters.

Atkin, Jeffres, and Neuendorf (1998) examine the demographic characteristics of the Internet adopters and non-adopters to test the diffusion of innovations paradigm. As suggested in the diffusion typology, they find that Internet users tend to be better-off and better educated than the population at large. Atkin, Jeffres, and Neuendorf (1998) also find that prior use of and interest in technology is a good predictor of Internet adoption, which also fits with Rogers's technologically-knowledgeable innovator profile. Internet adopters are also found to be more cosmopolite than non-adopters (Atkin et. al, 1998).

Many studies support Rogers' generalization that early Internet adopters are better educated and upscale (Atkin et. al, 1998; Lin, 1998). Interestingly, several studies suggest that individual demographic factors are statistically more significant in predicting Internet adoption than attitudinal or communication needs factors (Atkin et. al, 1998). Media usage is not an important predictor of computer and Internet adoption (Atkin et. al, 1998; GVV, 1998; ITU, 1999; Lin, 1998). Demographic segmentation then can be used by diffusion agencies to target specific adopter groups in the diffusion of new technologies, especially in the early stages of adoption. Demographic characteristics also should be used as predictors when studying Internet adoption by countries with lower Internet penetration levels.

### **Other Communication Technologies**

Garrison (2000) looks at the diffusion of online research tools in American newsrooms. These tools represent a particular aspect of the Internet and its diffusion to a particular group of users--American journalists. Garrison (2000) concludes that computers are already largely adopted as a newsgathering method and that the "value of interactive Internet information-gathering tools" has increased over time.

The rate of adoption (the number of people who adopt an innovation over a specified period of time) varies greatly between different technological innovations. The adoption of Nintendo games in the United States, for example, and the VCR was very fast (Rogers, 1986). Computers, however, have exhibited a slower rate of adoption. Weir (1999) examines the adoption of electronic newspapers and finds that it is different from that of other consumer products. Weir (1999) argues that this may be due to the fact that electronic newspapers are more like media than like software applications.

We cannot observe Internet diffusion unless there are personal computers adopted in the first place. As Lin (1998) indicates, PC's adoption rate in the United States has been relatively slow. She also finds that communication technology ownership is the strongest predictor of computer adoption rate (Lin, 1998). Lin argues that demographic predictors are still important to forecast computer adoption rates, but that is no longer the case for the VCR and cable television. This suggests that communication technologies' adoption and diffusion changes over time, both in terms of speed and type of adopter. This, in fact, supports Rogers's model, in which it is expected that innovators and early adopters may be demographically different than the later adopter groups. Among the laggards, early majority, and late majority there are no major demographic distinctions. Therefore, the strength of demographic predictors decreases over time.

Prescott and Slyke (1997) argue that (1) the Internet is a complex technology cluster and (2) its adoption is context-specific. The researchers ask the following questions regarding Internet adoption at the organizational level: Is the Internet radical versus incremental innovation, product versus process innovation, voluntary versus involuntary adoption, and pull versus push technology. Internet adoption will have

different dimensions in different contexts. For example, when a company adopts new software that does not change significantly the way business is conducted (just changes the application from text-based to windows-based software, for instance), this is an example of an incremental change (Prescott & Slyke, 1997). On the other hand, if the company introduces a Web-based software that allows customers for the first time to place orders online, we have a radical shift from previous organizational practices (Prescott & Slyke, 1997). The type of Internet adoption is contextual then--on a case by case basis, Internet adoption can fall into one or the other category.

### **Levels of Internet Adoption**

Not only is Internet adoption contextual, but it can also be divided into three different levels: individual, organizational, and societal. Most research to date has focused on either individual or organizational adoption. As Rogers (1995) says, however, we can also study adoption at the societal level.

One of the few studies that applies diffusion of innovations to the societal level conducted by Bazar and Boalch (1997) supports the traditional diffusion of innovations typology. They argue that Internet diffusion in developing countries is achieved when a critical mass is reached and the adoption becomes self-sustaining (Bazar & Boalch, 1997). The main institutions that play a role in the Internet adoption process within a country, according to Bazar and Boalch (1997), are the government, the carriers, funding institutions, and the information technology (IT) professional associations. Others have also found that national governments affect significantly the Internet diffusion process (Lin, 1993).

There are three different ways of approaching Internet adoption in terms of which level of adoption we are looking at. These levels, again, are the individual,

organizational, and societal level. With a global innovation such as the Internet, however, we need more insights about the societal level of adoption. At this level, different factors affect the rate of adoption, and diffusion of innovations, while useful, is not sufficient to explain country-level technology diffusion. A major limitation of the diffusion of innovations typology is the fact that it has been applied mainly to the individual and organizational levels. This dissertation contributes to knowledge on diffusion of innovations at the societal level.

### **Other Considerations for Internet Adoption**

Few studies on Internet adoption make a clear distinction between the software and hardware parts of the Internet, a distinction that Rogers (1995) considers important for any technology. Such distinction may reveal different patterns of adoption. In addition, we need to consider which aspect of the Internet is being examined (e.g., email) when we look at the adoption of the Internet from a diffusion of innovations perspective. Such delimitations are important yet difficult to make.

Internet adoption is also subject to whether it is voluntary or not for the individual adopter. As Rogers (1995) points out, there are authority or contingent decisions that apply to certain adoption situations. The diffusion process is different in cases of optional or collective adoption decisions. In this study, we assume that Internet users in the post-communist world have made a voluntary decision to use the Internet.

Wolcott et al. (2001) incorporate national systems of innovation (NSI) literature in their discussion of Internet diffusion theory. This body of research underscores the importance of national institutions for the diffusion of innovations within countries. NSI studies often include Research and Development (R&D) expenditure as a factor affecting the successful adoption of the innovation as well as other measures of training and

education (Nelson, 1993). Typically, countries with higher income levels have higher R&D expenditure so including both variables as determinants of Internet usage rates could be redundant.

A better conceptualization of the Internet itself is needed before we can fully understand its adoption at either the individual, organizational, or societal level. Some see the Internet as a technological innovation. Others describe it as a cluster of technologies. Some see the Internet as a culture (Wilson et al., 1996). Yet others talk about the Internet as a place (Poster, 1995). Many portray the Internet as a strategic national infrastructure (Maddon, 2000). Others have discussed its potential to enhance democratic governance and improve socio-economic development of developing countries in particular (Maherzi, 1997).

The Internet is very complex in nature and is still evolving. Therefore, further research on Internet diffusion and adoption is needed. The diffusion of innovations typology is useful overall, but cannot fully explain the adoption at the country level. This dissertation also draws on new media technologies literature, which is summarized in the next section.

### **New Media Technologies Research**

Diffusion of innovations basically postulates that the diffusion process occurs in stages over time. A main assumption of that theoretical paradigm is that (1) the diffusion process is linear and (2) different groups adopt innovations at different points in time. The width of adoption that can describe how widespread a technology is within a country is largely based on individual factors. Thus, audience variables are critical for explaining levels of Internet adoption. In particular, demographic factors such as personal income,

and educational level, and attitudinal factors such as cosmopolitanism and innovativeness have been identified as important in the diffusion of innovations model.

According to diffusion of innovations, external factors are also important for Internet adoption in developing countries. These include government policies and the existence of prior technologies. Multiple technology components are critical in the case of the Internet, as the above discussion of interactive and cluster innovations shows. Therefore, government policies and political environment as well as technological infrastructure can be used as predictors for Internet adoption.

The nature of interactive communication technologies and the Internet in particular requires us to draw from a multidisciplinary theoretical framework to explain variations in adoption (Lin, 1998). Several basic sets of factors have emerged in the growing body of new media technologies literature as predictors of country level Internet adoption. These are economic factors, political climate and policy factors, technology and infrastructure, audience characteristics, and cultural factors. This study proposes a conceptual framework including the afore mentioned five areas to explain Internet adoption at the societal level.

While certain prerequisites exist that affect adoption of new technologies, it is a difficult task to pinpoint exactly what drives Internet diffusion into different countries. Most studies to date have shown that the country's economic development plays an important role. The next section reviews literature on Internet adoption and economic development.

### **Economic Factors**

The argument exists that innovations are borne as a result of scientific discoveries. Some scholars have argued against this proposition, however, saying that the rate of

technological progress does not stem directly from basic scientific discovering (Romer, 1999). Rather, "it is the incentives created by the market that profoundly affect the pace and direction of economic progress" (Romer, 1999). Logically, then, technology growth is faster when these incentives are stronger. Many scholars have argued that business incentives and potential markets determine whether a new technology is introduced or not in the first place (Romer, 1999; Sale, 1999). Malecki (2001), for example, contends that commercialization has been the main catalyst for the development and growth of Internet technology.

The most evident predictor of Internet penetration in a country is probably the level of economic development (Arnum & Conti, 1998; Bazar & Boalch, 1997; Elie, 1998; Hargittai, 1999; Wolcott et al., 2001). The country's economic situation has a direct effect on Internet adoption. Studies have consistently detected a strong positive correlation between the level of economic development and Internet use in a country (Arnum & Conti, 1998; Clarke, 2001; Elie, 1998; Gunarante, 2001; Hargittai, 1999; Kiiski and Pohjola, 2001). Using World Bank data and classification, Figure 3 shows the uneven distribution of Internet hosts across countries with different income levels.

In addition to empirical data, previous research also shows that countries that are better off economically tend to have higher Internet penetration. Bazar and Boalch (1997) contend that capital (economic resources) are crucial for adoption of the Internet in developing countries. Richer countries in general have more resources to put into the service sector of their economies, which includes the information technologies (IT) sector (Elie, 1998). Previous research has also supported the assumption that richer countries

have more telecommunications networks and higher media penetration overall (Maherzi, 1997).

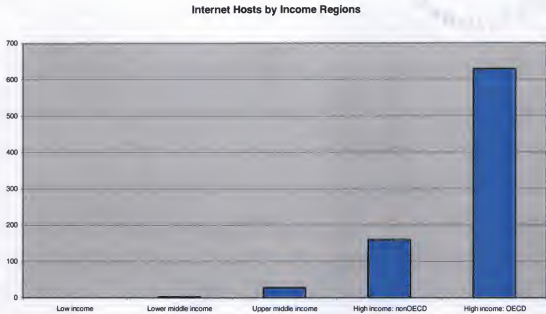


Figure 3-1. Internet hosts across income regions. Source: World Bank, 2000.

Bazar and Boalch (1997) examine Internet diffusion within developing countries' context. They define five categories that can be seen as prerequisites for Internet adoption in developing countries: national/organizational needs and opportunities in place (this concept is related to the nation's vision of the future and relative advantage of the country); technology (including infrastructure and Internet technology itself); necessary skills and people to introduce the innovation; capital (economic resources); and finally good management of the technology adoption and diffusion process. Again, they contend that economic resources are critical for Internet adoption at the societal level (Bazar & Boalch, 1997).

One of the few studies on Internet growth in the post-communist countries focuses on Internet use in enterprises within the countries (Clarke, 2001). Thus, the unit of

analysis is the individual enterprise and the dependent variable in the econometric model is whether or not an enterprise has access to the Internet. The main question that the study addresses is how enterprise ownership and foreign competition affect Internet access in the region. The sample includes 2,999 enterprises from Eastern Europe and Central Asia and uses the WBES database of the World Bank (Clarke, 2001). The main conclusion of the study is that foreign ownership of enterprises positively affects Internet growth. In addition, the results suggest that enterprises in smaller countries with higher income levels and larger urban populations are more likely to be connected to the Internet (Clarke, 2001).

Most studies of cross-country Internet adoption to date show that national income level is an important determinant. Elie (1998) and Hargittai (1999) find a strong correlation between Internet penetration in a country and per capita income. Hargittai (1999) examines how four country-level indicators affect Internet connectivity among OECD members. She includes the economic situation of the country (measured by GDP per capita) as well as education level, legal environment (regarding communication technologies) as well as infrastructure to explain differences in Internet connectivity. The GDP per capita is the strongest predictor in her model: it explains 38 percent of the variation. Rodriguez and Wilson (2000) also use GDP per capita as a predictor of ICTs use, as measured by and Index of Technological Progress (ITP). They find a strong positive correlation between ITP and GNP PPP, also arguing that richer countries make more technological progress over time than poorer countries.

Clearly, GDP or other macroeconomic indicators can be used as predictors of Internet adoption in a country. This is also a logical variable since it translates individual

income, which has been identified as important in the diffusion of innovations paradigm, to the country level.

Kiiski and Pohjola (2001) look at cross-country diffusion of the Internet using the Gompertz model of technology diffusion. Thus, their model is longitudinal and their dependent variable is the rate of change in the number of Internet hosts from 1995 to 2000. Their sample includes 23 OECD countries, similarly to Hargittai (1999). Their study concludes that the best predictors for adoption are GDP per capita and Internet access cost.

Some researchers, however, find no relationship between national income and Internet penetration. Surprisingly, the parameter for income per capita is statistically insignificant in a recent study at the World Bank (Dasgupta et al., 2001). Thus, the researchers conclude that economic development does not have a strong influence on Internet intensity. They extend this conclusion by noting that the disparity in Internet use is just a reflection of the "long-standing disparity in telecommunications access" between developed and developing countries (Dasgupta et al., 2001, 6). One possible explanation for this finding is that income and teledensity (telephone penetration per capita) are highly correlated and when one of them is included, the other does not appear to have an effect. However, there is no information on the bivariate correlations among the predictors given in the study.

Another economic variable that is clearly related to Internet use is price of Internet access. Petrazzini and Guerrero (2000) argue that there is an inverse relationship between price of Internet connection and Internet use. They find that once the price of leased lines and of tariffs for local calls in Argentina has been reduced, Internet growth increases

dramatically. Higher Internet prices are generally indicative of more restrictive telecommunications policies. They also present a barrier to Internet use of lower income demographic groups. However, the price of Internet access in the post-communist countries is not available; neither is any other synchronized country-level data on governmental policies regarding Internet access.

In addition to price of Internet connection and basic macroeconomic indicators, the size of the service sector of the economy has also been found an important factor for IT diffusion (Elie, 1998). The size of the service sector of the economy, however, is typically related to national income. Countries with higher per capita income tend to have bigger service sectors (World Bank, 2000).

When comparing some Western European and some Eastern European countries, Elie (1998) finds that Internet penetration differs from what would be expected only on the basis of macroeconomic indicators, however. Economically highly developed countries of Southern and Central Europe (such as France, Germany, Italy, and Spain) have lower Internet usage levels than predicted on the basis of their GDP levels (Forrester Research, 2000). On the contrary, the Internet seems more "developed" in the economically less advanced Eastern European countries of Slovenia, Czech Republic, Hungary, Slovakia, and Poland.

Arnum and Conti (1998) note a similar discrepancy. When calculating Internet ratio<sup>2</sup> per country, they show that France and Estonia are very close to each other in their Internet penetration. Similarly, Estonia and Slovenia were ranked higher than Hong

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<sup>2</sup> Instead of using the conventional measures of Internet hosts or Internet users per 10,000 people, Arnum and Conti measured Internet penetration per country as what they called an Internet ratio. The Internet ratio formula used in their study is: (Internet Hosts + Domains + Web Pages)/ Population.

Kong, Portugal, and Greece, in terms of their Internet ratio (Arnum & Conti, 1998). The study also concludes that several countries with relatively high levels of economic activity--for example, Saudi Arabia, Oman, Venezuela, and the U.A.E.--have surprisingly low levels of Internet activity (Arnum & Conti, 1998). These results suggest that although economic factors are important, there is more at stake in the case of Internet adoption at the societal level.

### **Political Climate and Policy**

Economic indicators by themselves cannot fully explain the diffusion of interactive communication technologies, such as the Internet. Even among rich countries, there is a large amount of variation in Internet penetration (ITU, 2000). A study focusing on the Organisation for Economic Cooperation and Development (OECD) members concludes that GDP by itself explains less than 40 percent of the variation in Internet connectivity (Hargittai, 1999). Other studies have indicated the importance of the political stability of a country on its overall development and adoption of new technologies (Berg-Schlosser & Siegler, 1990). Clearly, political instability will present an obstacle to fast Internet diffusion. A good example to support this claim is Rwanda, a country with serious political conflict in recent years. The most recent data from the World Development Report of the World Bank show that Rwanda has practically zero Internet usage (World Bank, 2000).

The democratization level of the country has been suggested to be an important predictor of Internet usage. Studies show some evidence that political freedoms are positively related to Internet use (Daly, 2000; Norris, 2001; Rodriguez & Wilson, 2000). Rodriguez and Wilson (2000), for instance, argue that a national democratic system is critical in the adoption of information technologies such as the Internet. They underscore

the significance of democratic rights and civil liberties for the creation of a climate where information and communication technologies (ICTs) can be easily adopted (Rodriguez & Wilson, 2000). Most accounts show a reverse relationship: countries with restricted political and civil liberties tend to have lower Internet usage levels, while democratic societies tend to encourage Internet growth.

Rodriguez and Wilson (2000) measure technological progress as a combination of TV sets, mobile phones, personal computers, Internet hosts, and fax machines. Their study shows the following four factors are critical for national technological progress: a climate of democratic freedoms that facilitates the adoption of ICTs; rule of law and security of property rights; investment in human capital; and finally low levels of government distortions. Interestingly, they found that a transition from the least free stage to a higher stage of civil liberties led to an increase in growth rate of technology of 18 percentage points (Rodriguez & Wilson, 2000). They also claim that "developing countries that successfully innovate and diffuse ICTs are able to open their political systems as well as their investment and commercial institutions" (Rodriguez & Wilson, 2000, 28). It seems that the relationship between Internet use and political freedoms may be circular.

Another study testing the relationship between democracy and Internet use shows that Internet penetration was highly correlated with higher political freedoms and democratization levels (Norris, 2001). Norris (2001) also argues that Internet adoption within a national context is generally affected by two broad factors: (1) socioeconomic development and (2) democratization. Empirical testing showed that national level of democratization is highly correlated with a New Media Index (Norris, 2001). When

controlling for income levels, however, democratization becomes insignificant (Norris, 2001).

One way of measuring democratization is by looking at the level of civil liberties (Pritchett & Kaufmann, 1998; Rodriguez & Wilson, 2000). Definitions of civil liberties vary. One organization that has consistently studied the level of civil liberties around the globe is the Freedom House. Their civil liberties ranking focuses on several areas, including freedom of expression and belief, independent media, freedom of assembly and demonstration, rule of law and human rights, and personal autonomy and economic rights in the country. The Freedom House civil liberties ranking emerges as the best proxy for democratization and will be used as a predictor in this study.

In addition to democratization, government effectiveness can also directly impact the rate of adoption of new technologies such as the Internet. Previous studies have shown that the role of government is crucial in the early stages of Internet adoption within a country (Bazar & Boalch, 1997; Lin, 1993). Lin (1993) argues that the American government, for example, has played a critical role in the development and growth of the Internet in the United States. National government policy has been critical for Internet growth in Latin America and Western Europe as well (Petrazzini & Guerrero, 2000; Tanner, 1999).

Policies are directly related to the political climate in a country (Godwin, 1998). A study of cross-country Internet diffusion includes policy and urbanization variables in addition to income to explain diffusion levels (Dasgupta, et al., 2001). Hargittai (1999) finds a strong explanatory power in policies regarding the telecommunication sector in her study of Internet connectivity among the OECD countries. Those countries that have

allowed free competition or even some degree of competition have a higher level of Internet penetration than countries with telecom monopolies, other things being equal (Hargittai, 1999).

Kiiski and Pohjola (2001) also include competition in telecommunications (measured as existence of some form of competition in telecom markets) as a predictor of Internet use. However, competition in their model is not found to be significant, in contrast to Hargittai (1999). One possible explanation is that they use both competition and access prices in one regression model. That combination can be redundant as the two variables are likely to be correlated. Typically there will be an inverse relationship: more competition will bring lower prices and vice versa.

Other researchers have also claimed that it is critical to take into account government policies when trying to examine levels of Internet adoption (Petrizzini & Guerrero, 2000; Sallai, 2000; Wolcott et al., 2001). This is especially important in the post-communist countries, which have been undergoing major political transformation have been trying to open up their telecommunications markets only since the early 1990s.

There is no doubt that government policies impact the pace of new technology adoption. Changes in the telecommunications industry in the 1970s and in the 1980s in particular have resulted in the introduction of privatization and liberalization policies in many countries around the world (Bauer, 1994; Gruber, 2001). Western European nations undertook a major shift toward telecom liberalization in the 1980s. Bauer argues that three main factors contributed to this shift: innovative equipment resulting from rapid technological changes; demand for customized and specialized telecommunications services; and desire by the large telecom equipment providers to enter foreign markets.

It is important to understand the significance of national policy for the creation of supportive Internet environment. Specifically, government support is needed to make the Internet affordable for the population at large (The Internet's new borders, 2001). A competitive telecommunications market becomes critical not only for the development of e-business, but for making the Internet more accessible to people. A World Bank report (1999) finds that telephone networks expand much faster in those countries that have privatized their telecommunications market. Even if the telecom operator is a privatized monopoly, it is claimed to be better than a state monopoly operator. Clearly national policies in the telecommunications sector are important and need to be considered in the study of country-level Internet adoption.

Government policy is found significant in a study of national computer imports. Caselli and Coleman (2001) examine cross-country technology diffusion by looking at the determinants of computer imports. Their study suggests that computer adoption is related to policy: higher levels of trade openness towards the OECD positively affect the number of computers in this case. The results also show that income per worker, investment per worker, and secondary education are significant predictors. All of these factors are positively related to computer adoption. The study also finds that computer adoption is negatively affected when having a large government share in GDP as well as large share of agriculture in GDP (Caselli & Coleman, 2001).

Privatization and liberalization policies directly affect the price of telecommunications devices and services. Prices have been claimed to be higher in countries with monopolistic telecommunications markets (Horvath, 2002; Jamison, 1995; Ryan, 1997). Fish (1998) underscores the importance of privatization and liberalization in

the post-communist world in explaining, at least in part, the relative differences across these countries (Fish, 1998).

Previous research shows that in general there are several stages in telecommunications reform. At the first stage typically we observe privatization of the incumbent state-owned telecom operator. At the second stage, competition in the telecom market is introduced. General, it has been found that competition is more beneficial to the consumer of telecommunications services.

Fish (1998) examines the power of privatization and liberalization combined as determinants of the long-term economic reform in the post-communist countries. These two sets of policies are important not only for the success of the economic reform in the region, but also for the facilitation of telecommunications development and restructuring from a centralized model to an open-market model. Paltridge (2000) argues that liberalization in telecommunications facilitates Internet development. Internet access prices are important factors as suggested by the vast variability in Internet usage across the OECD group (Paltridge, 2000).

Sometimes privatization needs to be preceded by the adoption of a clear-cut regulatory framework in the country (Wheatley, 1999). Wallsten (2002) argues that institutional reform and regulations need to be in place before the telecommunications firm is privatized in order to have a positive effect. In other words, he recommends having regulation first and then subsequent privatization in the telecommunications sector in any country.

It is critical to include the level of privatization when studying Internet penetration in the post-communist countries (Estache et al., 2002; Kuentzel et al., 2000; Maddock,

1997). Privatization has been a difficult process in the transition from centralized state economies to market-based economies in those countries (Ellis, 1999; Fish, 1998; Gospic, et al., 2000; Gulyas, 1998; Hoelschner, 2000; Jasinski, 1997; Papir & Oleszak, 2000; UNDP, 1999). As Bauer argues (1994), the post-communist countries "often have to create very favorable conditions for infrastructure service providers . . . to succeed in the attraction of foreign investment capital and technology." Lari (2000) underscores the importance of both financial and non-financial aid that international institutions need to provide for Eastern European countries. This need is especially acute in the area of telecommunications (Lari, 2000). In addition to attracting foreign capital, privatization in the telecommunications sector is also very important for competition and Internet growth in general (Gulyas, 1998; Sallai, 2000; Sokolov & Goldenstein, 2000).

As Maddock (1997, 166) points out, "Eastern Europe has followed the Latin American model by relying on liberalization to achieve reform but social and political disruption has meant that the potential gains have not yet been achieved." In all post-communist countries, the main telecommunications operator used to have a strong monopoly in the domestic market. In the past, the incumbent telecommunications operator often served as a tax collector and regulator (Canning, 1997; Maddock, 1997; Michalis & Takla, 1997; Xavier, 2000). The pricing structure was distorted by cross subsidies where domestic calls were artificially kept at a lower price, which was compensated for most often by high international tariffs.

Campbell (1995), in his overview of the telecommunications industry in the former Soviet Union, makes several observations, which are generally true for the rest of the Soviet bloc. He notes that the control of the Post, Telephone, & Telegraph (PTT) is

completely in the hands of the government. The monopoly, he notes, will be rather difficult to break as this sector is considered strategically important (Campbell, 1995). The Communist leaders did not view information and communications networks as its top priority. Campbell (1995, 25) concludes: "The telecoms sector illustrates the general problem that it is not that easy to just start over. The old system left a technological and organizational legacy that cannot be overcome quickly." The old structures--both institutional and physical--will take time to improve and open up even though the Cold War is over.

The telecommunications sector has been undergoing major reforms since then, but it has proven to be quite difficult to modernize. Looking at the former Soviet republics, Campbell notes that "telecoms policy is a result of what is happening under the general processes of privatization, antimonopoly policy, price regulation, and tax policy as much as by specific legislation on telecommunications" (Campbell, 1995, 207). Among the former Soviet republics, the Baltic states have been most liberal in giving autonomy to the telecom operator. Ukraine and Belarus, on the other hand, show less desire to change quickly. The reforms in these countries have been slower (Campbell, 1995). Central and Eastern European countries are trying to get closer to the regulatory framework of the European Union with their telecom legislation. The process of liberalization of national telecom markets is going faster in these five countries: the Czech Republic, Estonia, Hungary, Poland, and Slovenia (Bruce, 1999). However, there are different degrees of progress not only across the region, but also across these countries.

Dasgupta et al. (2001) show the importance of policy, measured as the degree of private sector competition in a study of cross-country Internet diffusion. However, this

measure does not directly capture the level of openness in the telecommunications sector in particular. Thus, the policy variable in this study can be questionable, even though it shows the expected direction of impact on Internet use. In addition, the policy index used in the study is based on data from 1995 while the rest of the variables are from 1990. This is another shortcoming of the policy predictor. This is a case in point that it is very challenging to find a good measure of national policies, especially as they relate to Internet development.

Indeed, it is difficult to measure the recent liberalization and privatization policies in the post-communist countries. It can be argued that the overall level of market openness within a country is reflected by the level of economic freedom, so the Economic Freedom index of the Heritage Foundation could have been used. However, as noted about the Dasgupta et al. study (2001), this can be misleading because if a country has adopted liberal economic policies overall, its policies in the telecommunications sector could still be very restrictive. Thus the level of privatization in telecommunications specifically needs to be used, when data permit, to explain Internet adoption levels.

Privatization by itself, however, may lead to negative results in some cases. Wallsten (1999) examined the effects of competition, privatization, and regulation in the telecom markets in a number of African and Latin American countries. He found that when regulation is introduced with the privatization reform, the effects tend to be positive. Again, regulation is also an important aspect of telecommunications reform. This study, however, measures only one aspect of telecommunications reform—telecom privatization, which is only the first stage in the liberalization process. Future studies

should try to incorporate not only privatization, but also completion and regulation variables, whenever possible.

### **Technology/Infrastructure**

Hargittai (1999, 705) notes that "existing telecommunication facilities may be crucial for understanding variation in the spread of the Internet." Bazar and Boalch (1997) identify technology as one of five determinants Internet adoption in developing countries, in addition to economic resources, needs and opportunities, necessary skills and people to introduce the innovation, and finally good management of the diffusion process. They position technology to include not only Internet technology itself, but the general infrastructure within the country (Bazar & Boalch, 1997).

Arnum and Conti (1998) argue that "[w]hat TV was to the second half of this century, what the telephone and the paved road were to the early 20<sup>th</sup> century, and what the railroad was to the 19<sup>th</sup> century, so too is the Internet to the current generation." Arnum and Conti (1998) relate the speed of adoption of new technologies to the prior existence of other infrastructure. They conclude that the Internet is more popular in countries that have long-established infrastructures for communications and transportation. Western European countries then will be more likely to have higher Internet adoption rates, as they have historically had widespread networks of transportation, communications, and other technological infrastructure.

Daly (1999) emphasizes that infrastructure in general varies widely across regions of the world. Since existing infrastructure significantly affects Internet adoption in a country (Arnum & Conti, 1998; Bazar & Boalch, 1997; Elie, 1998; Gulyas, 1998; Hargittai, 1999; Lin, 1998; Sadowsky, 1993), variations in Internet use are to be expected. Gulyas (1998) argues that a modern telecommunications network is a basic

requirement for a society to become an information society. Elie (1998) contends that the existence of a telecommunications network is critical for Internet adoption. Sadowsky (1993) discusses the substantial physical and capital investment required to build Internet infrastructure before a country can benefit from the Internet. He adds that the infrastructure in many developing countries is inadequate for more advanced network activities (Sadowsky, 1993).

In the former Soviet bloc, telephone infrastructure is generally inferior than the one in place in Western European countries. Looking at the ex-Soviet republics, Cambell (1995) notes that the telephone infrastructure in those countries is outdated and, therefore, the quality of service is low. He says: "Old-fashioned and worn-out switching equipment meant bad connections" (Cambell, 1995, 25).

Kiiski and Pohjola's study (2001) shows that infrastructure variables are critical for the increase in the number of Internet hosts per capita. Specifically, per capita telephone lines and number of PC's are included in their estimation (Kiiski & Pohjola, 2001). The researchers note that both telephone lines and PC's are strongly related to GDP so they may have a somewhat indirect effect on cross-country Internet diffusion. However, no partial correlations are provided.

One way to measure the existing telecommunications infrastructure in a country is telephone penetration (teledensity). Telephone infrastructure has been traditionally used in studies on Internet penetration (Clarke, 2001; Elie, 1998; Guillen & Suarez, 2001; Hargittai, 1999; Kiiski & Pohjola, 2001). The analytical framework proposed here will use telephone density as an infrastructure indicator, but will also include mobile phones in addition to residential phones.

Jupiter Research (2001b) projects a significant global increase in the number of mobile Internet users. In the developing world in general, mobile phones seem to play an important role. In some African countries, the number of mobile phone subscribers surpasses those that use residential phones. Interestingly, Uganda has more mobile phone customers than fixed telephone customers as of July 1999 (Minges, 2001). The popularity of wireless is evident in the Latin American region as well. Research shows that there is an emerging audience in Latin America which will access the Internet only or primarily from a mobile phone (Jupiter Research, 2001). The growth of the mobile telephone market in Eastern European countries has served as a major incentive for demonopolization of telecommunications service overall (Oaca, 2000).

It is true that Internet usage is dependent on phone line availability and also on computer availability. Clearly, to connect to the World Wide Web one needs to have a personal computer in the first place. Yet lack of data prevent us from using number of computers per capita as an independent variable in this study. Also, even though the association between Internet users and number of computers is relatively clear, the direction of causality between the two variables is not so obvious.

Another question that may arise is why not include cable infrastructure to account for broadband Internet users. Broadband use in the post-communist countries is very limited. Even in Western Europe, broadband Internet has not become very popular (Pastore, 2002). Pastore notes that Western European countries are not yet ready to go broadband. Specifically, the number of broadband users of all Internet households is about eight percent in France, nine in Germany and a very low two percent in Britain

(Pastore, 2002). In the post-communist countries, it will be quite a while before broadband technology becomes available nationwide.

### **Audience Characteristics**

Research to date has focused more on the supply side rather than the demand side when examining Internet diffusion within countries (Lamberton, 1997). Researchers have attempted to answer the question what demographic and attitudinal characteristics affect Internet adoption. Diffusion of innovations (reviewed above) shows that innovators and early adopters typically have higher socio-economic status, are better educated, more cosmopolite, and technologically savvy (Atkin et al., 1998; Rogers, 1995).

Audience characteristics affect Internet adoption in several ways then. First of all, education has emerged as a major determinant of Internet adoption both at the individual and country level. The higher the education level of the general population, the more likely people are to adopt new media technologies such as the Internet (Caselli & Coleman, 2000; Hargittai, 1999; World Bank, 1999). Lack of adequate education, on the other hand, can impede Internet diffusion. El-Nawawy (2000), for example, sees education as the primary deterrent to Internet growth in the case of Internet adoption in Egypt.

Caselli and Coleman (2000) contend that the choice of technology is driven by the human capital in a country. They conclude that countries that have more skilled labor adopt technologies that efficiently use that labor, which in turn leads to more capital. In contrast, countries with more unskilled labor adopt "less sophisticated" technologies and accumulate less capital as a result (Caselli and Coleman, 2000). Press et al. (1998) note that there are several determinants of Internet adoption, including the existing telecommunication infrastructure, financial resources as well as human capital. The

characteristics of the human capital then can be seen as drivers of or barriers to Internet adoption.

Kiiski and Pohjola (2001) examine cross-country diffusion of the Internet using the Gompertz model of technology diffusion. They include educational level as one of the predictors in their study (Kiiski & Pohjola, 2001). Surprisingly, education does not show statistical significance. This could be due to lack of variation across the countries, as they examine only OECD members. Another possibility is that years of schooling is not the best education variable to be used as a predictor of Internet adoption. Both of these explanations could be true because when the regression analysis is replicated on a world sample of countries and education is measured by university attendance, it becomes significant.

College education is critical in the new communications era. According to the World Bank, basic education is important overall, but "new, information-based technologies are more demanding in skills for diffusing, interpreting, and applying knowledge" (World Bank, 1999, 42). The report additionally notes that "countries at or near the technological frontier need strong tertiary education and research institutions to compete in the creation of new knowledge" (World Bank, 1999, 42).

English language proficiency is another important factor for Internet adoption since the World Wide Web is still dominated by English-language Web sites (Global Reach, 2000),<sup>3</sup> even though projections indicate that Chinese will become the dominant Web language by 2007. If more users speak English within a country, they are more likely to search for the predominantly English-language Web content. Sadowsky (1993), for

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<sup>3</sup> Even though the domination of the English language is expected to wane, it was still by far the predominant online language at the time this study was conducted.

example, argues that the ability to find online content is critical for Internet popularity in developing countries. Interestingly, the rapid growth of Internet use in Bolivia has been connected to the increased Spanish-language online content (Minges, 2001). English language fluency facilitates not only content retrieval, but also computer and software usage.<sup>4</sup>

Wallraff (2000, 61) contends that “most people like new technology better when it speaks their own language.” Even though the English language has achieved a global status, the proportion of English-speaking people is expected to shrink to less than five percent in 2050. (Wallraff, 2000).

Caselli and Coleman (2001) include the fraction of the population who speak English as a predictor of computer adoption. They test for the effects of English or European language skills of the population. The language variable in this study is defined as the proportion of those who speak English as a first language (Caselli & Coleman, 2001). The results of their study, however, show that fluency in English is not statistically significant.

Hargittai (1999) defines “human capital” as related to Internet usage to include educational level and English language proficiency. The addition of human capital significantly improves the fit of the regression model. Hargittai (1999) finds that education is positively correlated with level of Internet adoption (i.e., the higher the educational level in the country, the higher its Internet connectivity). On the other hand, lower education levels may prevent mass adoption of the Internet.

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<sup>4</sup> Most computer commands, instructions, and help files are in English.

Similarly to Hargittai (1999), Kiiski and Pohjola (2001) include English language proficiency in their model. Hargittai's study shows no significance for the English-language variable. Even more unexpectedly, the English language variable in the Kiiski and Pohjola (2001) analysis has a negative sign. It could be inferred that at this stage of adoption among the OECD group of countries, English language is not a significant factor.

The framework proposed here defines audience factors as including both educational level and level of English language proficiency. If data permit, both will be used as predictors for the level of Internet penetration in the post-communist countries. These are the two most important audience characteristics identified in current literature on new communication technologies adoption.

### **Cultural Factors**

Finally, it has been argued that culture affects Internet adoption in a country (Elie, 1998; Maitland, 1998). Elie gives the example of European and Asian former Soviet republics, claiming that GDP and telecommunications infrastructure cannot explain the differences in their Internet positions. Maitland (1998) argues that culture should be included as an explanatory variable of the adoption of interactive technological innovations, such as the Internet. She argues that adding cultural differences makes the understanding of Internet diffusion across countries more robust (Maitland, 1998).

Researchers acknowledge that the construct of culture is very complex (Jones, 1997; DiMaggio, 1997; Sondergaard, 1994; Tayeb, 1994). Writing in Britain in the late 1950s, Raymond Williams conceptualized one of the first definitions of culture. He wrote: "Culture is ordinary: that is the first fact. Every human society has its own shape, its own purposes, its own meanings. Every human society expresses these, in institutions,

and in arts and learning" (Gray & McGuigan, 1997, 6). Broadly defined, culture refers to the values, religious beliefs, ethics, institutions, customs, and traditions shared by a group of people. Thus, cultural traits are innate to all individuals living in a social system. They are embedded and transparent within the culture.

DiMaggio (1997) among others points out that culture is a very complex concept. Sociology and psychology researchers have looked at various dimensions of culture and cognition. DiMaggio (1997) suggests that culture is fragmented across groups. The move from understanding culture as a unified to fragmented phenomenon "makes studying culture much more complicated" (DiMaggio, 1997, 265).

Hofstede (1980), however, sees culture as cohesive and manifested in national societies where people within the country share certain beliefs and attitudes. This conceptualization supports Williams' definition of culture (Gray & McGuigan, 1997). Culture then exists at the societal level as an aggregate of individuals' shared beliefs and attitudes.

Hofstede (1980) developed four dimensions to measure differences across cultures: power distance, uncertainty avoidance, individualism and collectivism, and masculinity and femininity. The cultural dimension which relates to the adoption of new media and the Internet is uncertainty avoidance (Hofstede, 2001). Broadly defined, uncertainty avoidance is "the extent to which the members of a culture feel threatened by uncertain or unknown situations" (Hofstede, 2001, 161). It follows that countries with higher uncertainty avoidance would be more resistant to the adoption of the Internet compared with low uncertainty avoidance countries.

Katchanovski (2000) examines the influence of culture on economic growth in the post-communist societies. He concludes that cultural differences do affect growth both directly and indirectly. Katchanovski (2000) derives a cultural index on the basis of five aspects of culture. His factor analysis identifies one factor consisting of civil society index, religion, historical experience, and business index, which is labeled Western Culture Index. The addition of cultural variables improves the fit of the regression model, with the Western Culture variable showing the highest standardized regression coefficient.

Domanski (2000) looks at religion and its effects on modernization in Eastern Europe. The results of the study show a correlation between religiosity and social stratification. It is clear that different religions are dominant in the different countries. Based on 1993 data from six Eastern European societies, Domanski (2000) argues that Poland is the most religious and the Czech republic the least religious of those. The level of religiosity across all post-communist nations is expected to vary even more.

Cultural traits have been given as an explanation for differences in Internet adoption among Western European countries (Forrester Research, 2000). Several studies support the argument that culture influences the diffusion of technology in a country (Maitland, 1998; Rey, 1998). Some studies divide Western European countries depending on their geographic location (Beilock & Dimitrova, 2003; Kiiski & Pohjola, 2001). Kiiski and Pohjola (2001) include a dummy variable for OECD countries depending on whether they are located in southern or northern Europe (N=23). Beilock and Dimitrova (2003) regress Internet usage rates against the percent of Roman or Orthodox Catholics in each Western European country. Interestingly, these cultural variables show statistical

significance in both studies. In fact, the model fit improves once the regional dummies are added in the Kiiski and Pohjola study (2001). Therefore, they conclude that there are certain cultural factors that play an important role in the process of Internet diffusion.

Drawing from diffusion of innovations, Maitland offers five propositions how culture can influence the adoption of interactive technologies at the country level. Maitland positions gender equality as a social norm. Interestingly, she argues that the diffusion of interactive networks, such as the Internet, will be higher in countries with higher gender equality. Maitland (1998) extends the notion of "cosmopolitanism" from diffusion of innovations to the country level. Basically, she suggests that openness of society can be measured by the country's ethnocentrism, and that cultures low in ethnocentrism will begin the diffusion of interactive networks earlier. This argument has been supported by others as well (Rey, 1998). The way of measuring countries' ethnocentrism can be problematic, however.

Religion is an important part of culture. In a study of economic reform in the post-communist world, Fish (1998) includes religion as a determinant. First he uses three categories for religious affiliation, but his ANOVA comparison of means indicates that there is, in effect, no statistical difference between the Muslim/Buddhist and Eastern Orthodox group. The analysis shows that the number of religion categories can be reduced to two, namely the Catholic/Protestant countries as group 1 and the Muslim/Buddhist and Eastern Orthodox countries as group 2 (Fish, 1998). Western Christianity arguably shows similarity with Western culture/societies. The results in the Fish (1998) study, however, show no effect of religion on economic growth.

The fifth dimension of our Internet diffusion model will be cultural factors. These will be represented by dominant religious composition of the population. Incorporating this variable with a focus on the three dominant religions also allows for measuring a particular aspect of culture--Westernization--though the Western Christianity variable.

### **Conceptual Framework**

The diffusion of innovations literature reviewed above posits that diffusion is a linear process. It identifies several individual characteristics that are critical for Internet diffusion, namely income, educational level, cosmopolitanism and innovativeness traits. The income and education levels of the audience are critical in the adoption process. Diffusion of innovations research also shows that externalities are important for Internet adoption in developing countries. Government policy and preexisting technology are among the determinants identified in diffusion of innovations literature.

New media technologies research, too, supports the notion that the political climate and technological infrastructure are critical for Internet use. Past research suggests that economic factors remain one of the most significant determinants of Internet adoption at the country level. New media technologies studies also show that audience characteristics (human capital) as well as cultural factors play an important role in the diffusion process.

Thus, a multitude of factors emerge as significant for the Internet diffusion process at the societal level. The five sets of factors identified in diffusion of innovations and new media technologies literature constitute the conceptual framework used in this study.

They are:

1. Economic factors
2. Political climate and policy factors
3. Technology/Infrastructure factors
4. Audience factors
5. Cultural factors

This five-dimensional analytical framework for the study of Internet adoption at the country level is proposed and tested in this dissertation. Specific variables pertaining to each set of factors are described in the following chapter.

### **Further Thought**

Rogers posits that innovations have the following five attributes: relative advantage (whether the innovation is better than previous ones), compatibility (whether it is compatible with previous technologies), observability (how hard it is to use the innovation), trialability (whether a person can try out the innovation), complexity (how difficult it is to use it) and observability (whether the results of the innovation are readily observable). He adds reinvention as the sixth additional attribute. Reinvention refers to cases when an innovation is used in a new way/for completely new purposes.

These six innovation attributes and the five dimensions identified here interplay with each other. The framework proposed above includes economic, political climate and policy, technology/infrastructure, audience characteristics, and cultural factors. These are conceptualized as country-level determinants of Internet adoption. Below, some possible influences on Internet adoption patterns as a result of the interactions between the two models are described.

The Internet is a very complex innovation. It can be used for a number of different purposes, ranging from email to data searches to online marketing. The relative advantage of the Internet will be higher for people who can see its value as a marketing tool or even as a way to market their products abroad. In fact, countries in the lower middle income range (such as many of the former socialist republics) may gain more by using the Internet for import and export of various goods or services. In other words, the

relative advantage of the Internet will be higher for countries with lower national incomes, which also tend to be less involved with international trade.

The Internet is not compatible with almost anything that existed prior to it. That means countries with very low Internet may need to have special training programs for potential users to show them how the Internet works. Countries with lower GNP levels are less likely to spend money on training courses. The combination of lower income and lower compatibility will make the adoption process in those countries for the Internet slower, compared with innovations with higher compatibility in a country with the same income level.

The benefits of Internet use are readily observable. Messages travel instantly and information (usually) is downloaded very fast. Countries with lower income levels, however, do not take advantage of higher speed Internet as much as they lack broadband technology (ITU, 1999). Thus, the results of Internet browsing, emailing, downloading and so on can be a little slower. If the user does not have a basis for comparison though, this interaction is unlikely to have an effect on the rate of Internet adoption. The more observable the results are to the users, the more likely they would be to go online again in the future.

The trialability of the Internet as an innovation is also likely to affect its adoption. If a person cannot try/does not have access to an Internet terminal, they are unlikely to adopt it. Again, poorer nations have lower Internet penetration. Especially in rural/remote areas, people have no access to the Internet. Countries with lower national income will have less Internet connections/terminals available for public use, which means that the potential adopter will have fewer chances to try out the Internet. This means they will

be less likely to adopt compared to persons in countries where the Internet is widely spread.

People in more affluent societies tend to have access to more technologies and other communication innovations (e.g., personal digital assistants or PDAs). In a way, they are more likely to reinvent the Internet from say, just a typewriter or email box, to use for online banking. (Online banking, of course, is related to a whole network of technologies, software products, bank accounts security and other issues).

Some governments may adopt policies facilitating Internet penetration, especially if they perceive the ability to receive public feedback online as valuable. Thus, the relationship here is reversed: those political leaders who see the Internet as a tool for encouraging public participation may be more likely to pass legislation that promotes Internet adoption. Alternatively, those governments which see the Internet as a threat are likely to adopt measures to limit its use.

As my dissertation proposes, privatization and liberalization policies can facilitate Internet development and thus make it more available for people to try. This interaction shows that for countries with more favorable market policies, the trialability of the Internet will be higher. This interaction is likely to lead to faster adoption rates. Also, if the beneficial results of Internet use are obvious for the policy makers, then adoption will be promoted by favorable policies.

People who live in a country with limited communication technologies will see more relative advantages of the Internet, as it is likely to be one of the few ways to connect with people or get information. People who live in country with extensive technological infrastructure will find the Internet more compatible, will have an easier

time using the Internet and trying it out in general, will find it less complex and may even be more likely to reinvent its use because of their previous experience with various technologies.

Those who can read English will be able to find much more information online and thus will perceive the Internet as more valuable. A person who can only read Macedonian is limited in the amount of online content he/she can locate compared to another person fluent in English. If the person uses the Internet for email only, that will not be a major issue, however.

Arguably, people with higher education levels will see more value in Internet information, particularly highly specialized information in their professional areas. In addition, more educated people will be more likely to want to have professional contacts with others around the world. Thus the Internet with its email and bulletin board capabilities can be considered even more valuable.

A person with higher education is more likely to have used a personal computer (PC). Therefore, such people will find the Internet more compatible with their previous experiences as opposed to those who have never used a PC.

Some religions may view the Internet as more valuable than others. More closed societies definitely are not as likely to embrace the Internet compared with more open societies. Also, societies which have been isolated in terms of information from the outside world may see the Internet as fulfilling an acute need--they will then perceive the Internet as more valuable.

Some societies are more open to new ideas and find it easier to adopt new technologies. Thus members of more open cultures may find it less complex to use the

Internet and also more compatible with their cultural predispositions. Certain cultural traits can affect the way people use and come up with reinvention ideas for various technologies.

## CHAPTER 4

### METHODS

This chapter outlines the methods for testing the five-dimensional analytical framework proposed in the previous chapter. The main research question addressed in this study is what factors affect Internet adoption in the post-communist countries. Six testable propositions are made. The study aims to identify the most significant predictors of Internet adoption and explain a significant portion of the variation in Internet use. Operational definitions, data collection methods, and hypotheses are proposed below.

The method chosen is governed by the primary research question and the nature of the data. The research design is described next.

#### **Research Design**

The literature review identified five sets of factors that affect Internet diffusion at the country level. These are economic factors, political climate and policy, technology/infrastructure, audience characteristics, and cultural factors. To use these factors in a systematic, multivariate analysis, they need to be further defined as specific variables pertaining to each set of factors. The operationalization of variables is shown in Table 4-1. The study uses secondary data from a number of different sources. Data sources and collection methods are provided below. The study employs t-test, multiple regression, and Tobit analysis to test hypotheses and examine the significance of the set of explanatory variables. Theoretical propositions and statistical procedures for testing them follow.

Table 4-1. Definition of variables in the proposed model of Internet diffusion.

T Y P E	VARIABLE	DEFINITION	OPERATIONAL DEFINITION	NAME	DATA SOURCE	YEAR
DEPENDENT	Internet users	Individuals using the Internet in a particular country, per capita	Estimated Internet users per 10,000 people	IUR	ITU	1999, July
ECONOMIC	Gross national product	GNP per capita, Purchasing Power Parity	The total domestic and foreign value added claimed by residents within or outside the country's borders, converted to the U.S. dollar value of the goods and services which can be purchased within the country in the local currency.	GNP	World Development Indicators	2000 <sup>1</sup> (1998)
POLITICAL	Level of privatization in telecommunications	Length of privatization of incumbent telecom operator	Number of years since the incumbent has been privatized, either fully or partially	PRIV	PrivatizationLink, MIGA (part of the World Bank)	1999
	Democratization	Level of civil liberties	Composite ranking based on 14 criteria	DEM	Freedom House	1999
TECH	Teledensity	Number of residential phones per capita	Number of telephone lines per 1,000 people plus the number of mobile phones per 1,000 people	TEL	ITU	2000 (1998)

<sup>1</sup> Even though the World Development Indicators Report was issued in March 2000, most of the data are from 1999 and 1998.

Table 4-1. Continued.

T Y P E	VARIABLE	DEFINITION	OPERATIONAL DEFINITION	NAME	DATA SOURCE	YEAR
AUDIENCE	Education level	Enrollment of college students	Tertiary percent of relevant age group, gross enrollment ratio	EDU	World Development Indicators	2000 (1997)
CULTURAL	Religion	Predominant religion	Two dummy variables, using Eastern Orthodox as a base: 1 if Western Christian (Catholic or Protestant) and 0 otherwise; 1 if Muslim/Buddhist and 0 otherwise.	MSL, WST	Fish; CIA World Factbook; U.S. State Department	1998; 2000

### Data Collection

The study uses secondary country-level data from a number of sources. It is important to underscore that comparative data for the post-communist countries are difficult to find. Fish notes that there "exists no reliable cross-national survey" that encompasses all post-communist countries (1998, 37). Aggregate data from international organizations--notably the International Telecommunication Union (ITU) and the World Bank (WB)--are used in this study. Thus, definitions of indicators are drawn directly from the original data source. Alternative data sources are also used to cross-check the telecommunications data in particular.

The main data sources as shown in Table 4-1 are: Freedom in the World published by the Freedom House; PrivatizationLink of the World Bank; World Development Indicators published by the World Bank; and the World Telecommunication Indicators

Database published by the ITU. National government sources are also used in cases when secondary data are not available from the international organizations noted above. For the religion variable, the work of Fish (1998) is used as the main data source and cross checked against the CIA World Factbook and country data from the U.S. State Department Web site. Additional sources are noted in the statistical analysis.

### **Operational Definitions**

It is critical to determine which potential variables best reflect the broad set of factors identified in the literature review.

#### **Economic variable**

The main economic indicator to be used is per capita income. Gross national product (GNP) per capita is the variable chosen in this model. This standardized variable is a key indicator of national economic development and allows easy comparisons across countries (Kennedy, 1998). The GNP measure includes the total domestic and foreign value added claimed by residents as well as net receipts of primary income (both compensation of employees and property income) from nonresidents (World Bank, 2000). GNP is calculated in U.S. dollars, using the Atlas method for conversion. However, GNP in terms of purchasing power parity (PPP GNP) is more appropriate for this study as it reflects the citizen's ability to buy goods and services (Arquette, 2002; Beilock & Dimitrova, 2003), such as Internet connection or dial-up services. PPP GNP is the U.S. dollar value of the goods and services, which can be purchased within the country using personal income in the local currency. Thus, an "international dollar has the same purchasing power over GNP as a U.S. dollar has in the United States" (World Bank, 2000, 13). The income variable will be log-transformed, based on Rodriguez and Wilson (2000).

A few methodological notes are in order. First, the GNP data for Bosnia and Herzegovina and for Ukraine come from the next edition of World Development Indicators, using 1999 data--not 1998. Yugoslavia's GNP data is based on data for Macedonia, because of the inherent similarity between the two transition economies.

### **Political climate and policy variables**

The political climate is measured by the level of democratization in the post-communist country, which is demonstrated by the level of civil liberties. Thus, a good proxy variable for the level of democratization in the country is the Freedom House ranking of the level of civil liberties. This ranking is based on 14 different criteria, which include freedom of expression and belief, free and independent media and freedom of cultural expression. The Freedom House has collected data on civil liberties within countries since 1972. It publishes an annual assessment of the state of freedom within a country by assigning a score to each state worldwide. The civil liberties ratings range from 1 to 7. A rating of 1 refers to a country considered "Most Free" while a rating of 7 denotes "Least Free" countries. The scores will be inverted for analysis so that higher rankings indicate higher levels of civil liberties in society. The inverted ratings also make interpretation of the regression coefficients easier.

The civil liberties variable is a proxy for the level of democratization in the country. In other words, the higher the level of civil liberties, the more democratic the country is. Similarly to the Rodriguez and Wilson (2000) study, the civil liberties variable is treated as interval even though it is an ordinal variable, similarly to the Rodriguez and Wilson (2000) study. The difference between a country with a score of 5 and a country with a score of 1 is not exactly 5 times, but this is assumed to be a good approximation established by the Freedom House foundation.

The policy variable used is the length of telecommunications privatization. At first glance, privatization can be seen as an economic variable. However, it belongs in the political climate and policy category as it is a direct result of the decisions of the political leaders in the country. The specific sector of interest in this study is telecommunications. There is no consistent cross-country data on overall telecommunications policy in the region. Thus, the study uses privatization of the incumbent telecommunications operator as the best proxy for telecommunications policy in the country.

In this study, we assume that earlier privatization of the main telecom operator is an indication of successful national policy in the area of telecommunications. In Bulgaria, for example, the privatization of the main telecom operator, BTC (Bulgarian Telecommunications Company), has been seen as one of the major privatization transactions on a national level, comparable with that of the national electricity operator and major tobacco companies. The fact that BTC's privatization has been extremely difficult and slow is an indication of poor policy making on the part of the Bulgarian government.<sup>2</sup> This policy has allowed BTC to continue its monopoly. The reverse is true in the case of Hungary: The major telecom operator MATAV was privatized in 1993 and is considered a major sign of the success of Hungarian telecommunications policymaking.

The definition of the telecommunications privatization variable is number of years since the incumbent telecom operator has been privatized, either fully or partially, at the end of 1999. This operationalization provides a method for determining the length of the telecommunications privatization in the respective countries. The length of privatization

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<sup>2</sup> BTC's still pending privatization has not been completed as of end of 2002.

is clearly related to telecom deregulation in these countries, which makes it a good proxy variable<sup>3</sup> to be used in this research.

### **Technology/Infrastructure variable**

A number of variables that measure Information and Communication Technologies (ICT) infrastructure exist. For the purposes of this study, only telephone infrastructure is included, even though cable, TV, and other technologies can also play an important role in Internet development. Broadband technology is not yet a viable option for Internet connection in the post-communist countries. The telephone provides the main mode of network connectivity in the region and has been used as a determinant of Internet adoption in a number of studies (Beilock and Dimitrova, *In press*; CDT, 2000; Hargittai, 1999).

A logical possibility for an infrastructure variable in this model would have been the number of computers per capita. As mentioned in Chapter 3, we cannot account for Internet users if we do not have computers in the first place. However, lack of data for the majority of the countries of interest prevents us from using that variable.

The most significant infrastructure variable regarding Internet usage is the number of telephones in the country. Thus, the main infrastructure variable used here is the number of residential phones per capita. This is measured by the International Telecommunication Union (ITU) as telephone mainlines per 1,000 people. This measure includes all telephone lines connecting a customer's equipment to the public switched telephone network (PSTN).

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<sup>3</sup> Another potential measure of political climate and policy would have been the level of economic freedom. Economic freedom is commonly measured by the Economic Freedom Index, which is based on 10 areas, including government intervention, property rights, and foreign investment. However, economic freedom does not directly reflect openness in the telecommunications sector, which is of particular interest in this study.

However, mobile phones play an important role in the technological advancement of the post-communist societies. The growth of the mobile market in the post-communist countries has been seen as a basic representation of the overall market demonopolization, as noted in Chapter 3. Also, technology today allows users to connect to the Internet via a mobile phone. The number of mobile phones per 1,000 population is then combined with the number of residential phones per 1,000 population into one independent variable called teledensity. The only disadvantage of using this composite variable is that we cannot compare the separate effects of mainline telephones and wireless.

### **Audience variables**

Two critical characteristics of the audience as Internet users were discussed in the literature review. The most important variable in this category is educational level. Past research shows that early adopters of the Internet tend to be more educated and usually hold a college degree (Atkin et al., 1998; Howard et al., 2001; ITU, 1999). Thus, the study uses educational level as measured by the gross enrollment ratio in tertiary education of relevant age group. This variable shows how many people in the relevant age bracket are attending college in a particular country.

As the literature review showed, people who speak English are more likely to go online and have an easier time browsing the Web. The best proxy variable for English language proficiency is looking at the number of students who take English as a foreign language in school. One way to measure it is as the percentage of pupils in secondary education learning English. However, such data are limited only to current or future members (the so-called candidate countries) of the European Union. Thus, English as a second language is not included in the final regression model, but is recommended for future studies.

### **Cultural variable**

Arguably, the best cultural measure is the dominant religion in the country. As Fish observed about the post-communist region, "in the overwhelming majority of countries, a single religious tradition clearly predominates" (1998, 41). National religion is a stable variable, not quick to change (Fish, 1998). Using data from Fish (1998) and the CIA Factbook (2000), the study incorporates religious affiliation as a cultural variable.

Orthodox Christianity is the most common religious group in the sample. The other two major groups are Western Christians and Muslims. It is argued that these three groups are substantially different from each other (Fish, 1998). The following nine post-communist countries are predominantly Western Christian (Catholic or Protestant): Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia. The majority of the countries are predominantly Eastern Orthodox (Armenia, Belarus, Bulgaria, Georgia, Macedonia (FYROM), Moldova, Romania, Russia, Ukraine, and Yugoslavia (Serbia and Montenegro). Therefore, Eastern Orthodox religion will be used as a base group for the dummy variables (coded as 0). The remaining nine countries are predominantly Muslim, with the exception of Mongolia.<sup>4</sup> Thus, two dummy variables will be employed to represent the three major religions in the region.

### **Dependent variable**

The dependent variable of interest in this analysis is Internet users per capita. This indicator is measured by the International Telecommunication Union (ITU) as the estimated number of Internet users based on the number of Internet hosts in the country. The dependent variable in this study will be transformed as a natural logarithm of the

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<sup>4</sup> Mongolia is a predominantly Buddhist country, but is included in the Muslim group in this analysis, based on Fish (1998).

number of Internet users because the distribution of that raw variable is skewed. Logarithmic transformations are especially useful in cases when the normality of the distribution is violated, usually resulting from the magnitude of the changes in the observed variable. Therefore, the interpretation of the beta coefficients is in terms of ratios, not in additive terms. When the data have been log-transformed, the slope indicates a ratio of change (increase or decrease) in the dependent variable.

The number of Internet hosts is collected by Network Wizards on a biannual basis.<sup>5</sup> These data are used to estimate the number of Internet users per country. Internet hosts and Internet users are the most commonly used measures for country-level Internet penetration (Press et al., 1998). For complete explanation on data processing of the raw Internet host data, check the World Telecommunication Indicators 2000/2001 edition or visit the ITU Web site (<http://www.itu.int/ITU-D/ict/publications/wti2000-01/>). A brief explanation follows.

The number of Internet hosts per capita refers to individual computers connected to the Internet--i.e., computers with an actual IP address. Network Wizards collects data on active Internet hosts worldwide. This measure of Internet usage has been criticized in the past (OECD, 1998a; Minges, 2000; Press, 1997; Zook, 2000). One reason is that Internet hosts are misleading if more people use the Internet at Internet cafes rather than at a home computer. In addition, Internet host figures are derived on the basis of country code top level domains (TLDs) rather than actual physical location of the host. As Minges (2000) explains, a host under the .RU country code domain can be located anywhere in the world, not necessarily in Russia. By the same token, the so-called generic TLDs (.com,

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<sup>5</sup> A detailed description of Network Wizards' data collection methods can be found at <http://www.isc.org/dsview.cgi?domainsurvey/new-survey.html>.

.edu, .gov, .int, .mil, .net, and .org) can be located in any country.<sup>6</sup> However, Internet hosts are a conservative measure of Internet connectivity (Hargittai, 1999; <http://www.matrixnetsystems.com>). Even though this measure has some shortcomings (Minges, 2000; Press, 1997; Zook, 2000), it remains the most common measure of Internet usage across countries (Press et al., 1998).

Another possible dependent variable is the number Internet subscribers per telephone line. A study by Dasgupta, et al. (2001) used the number Internet subscribers per telephone mainline as the dependent variable measure of national Internet use. Such data are collected by the Economist Intelligence Unit (EIU)'s Pyramid Research. However, this measure of Internet use can be misleading as many users in developing countries log on the Internet from cyber cafes or from work. EIU's data also seem to have lower reliability than the Network Wizards data.

As previous research indicates, there is no absolutely reliable estimate of the number of users per host per country, and Internet metrics in general have been somewhat inconsistent (Minges, 2000; Press, 1997; Rood, 1999; Zook, 2000). Measuring the level of Internet adoption is a challenging task for many reasons. One is that there are qualitative differences in terms of usage. For example, some users have access to broadband connection or more advanced software than others who are limited by a 28K or 56K modem. A person using a dial-up modem to connect to the Internet has a different experience of the Net than a high-speed user.

Additional Internet penetration indicators have been developed to include the following six different characteristics for country-level Internet adoption: pervasiveness,

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<sup>6</sup> Only seven generic top-level domains existed at the time this study was conducted. More generic TLDs have been licensed by ICANN today.

geographic dispersion within the country, sectoral absorption, connectivity infrastructure, organizational infrastructure, and sophistication of Internet use (Press et al., 1998). The combination of these six characteristics could provide a fuller picture of the overall Internet penetration than using simply one measure, such as Internet users per capita. However, collecting data for each of the six variables requires experts to evaluate and rank each country for each characteristic. Therefore, such data are unavailable for most countries in the world. Another disadvantage of such measures lies in the subjective nature of the ranking decision. At the present time, Internet users per capita represents the most reliable measure of Internet penetration that can be used. It has the added advantage that its values are easily comparable across countries.

Arguably, the best way to measure Internet users per country is by using panel members from a national sample. This involves systematic sampling techniques and is more precisely connected to an individual user. In other words, data is collected from users' home computers, not from network traffic information. In the United States, there are two companies that collect such data: Jupiter Media Metrix and Nielsen NetRatings. However, no such research companies exist in the region examined here.

Even the methods used by such market research companies involve some inconsistencies, which makes data comparisons difficult. Minges (2000) argues that national surveys of Internet users often look at different demographic groups, for example. Many research companies collect data on 16+ and 18+ age group categories. Minges (2000) argues that looking at adult populations only disregards an important part of current Internet users, precisely the younger population. In addition to age

breakdowns, geographic breakdowns and category breakdowns (users at work, at home, and at school) vary widely across research companies.

Network Wizards' Internet host data has been commonly used by researchers. Companies may adjust their Internet host data using a variety of methods. Matrixnet is one company that produces adjusted measures based on Network Wizards' Internet hosts counts. Their approach is to adjust the raw data from Network Wizards using statistical estimations for localizing the host data.<sup>7</sup>

Several other sources provide their own estimates on Internet users per county. Nua is an Irish-based company that reports the number of Internet users per country. They collect survey data from national surveys conducted by market research firms or journalism reports, and aggregate these data. In some cases, Nua can decide to use one source over the other, if the source seems more reliable. The problem is that there is no consistency between the methodologies used in different countries. In addition, national surveys are often conducted infrequently and inconsistently. The Nua Web site says that they consider a user anyone who used the Internet at least once for the past three months, or sometimes, for the past six months. That makes the Nua Internet users data unreliable and comparisons based on such data very difficult.

It is very hard to estimate how many people are using the Internet within a country (Daly, 1999; Press, 1997; Zook, 2000). One of the challenges for developing countries in particular is that people often use email from Internet cafes or cyber cafes. These types of use are more prevalent there than they are in the developed countries. The conclusion is that ISP subscriptions may underestimate the numbers of Internet users as a result (Daly,

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<sup>7</sup> A detailed description of Matrixnet's methodology can be found at [http://www.matrixnetsystems.com/company/research/library/how\\_matrix\\_gets\\_its\\_host\\_counts.jsp](http://www.matrixnetsystems.com/company/research/library/how_matrix_gets_its_host_counts.jsp).

1999). Another obstacle is the unwillingness of ISPs to disclose user data as they are facing competing ISPs (Daly, 1999).

Another company that tracks down the number of Web sites on the Internet is Netcraft. However, there is no direct relationship between the number of Web sites and the number of Internet users per country (Press, 2000).

### The Model

The variables described above can be divided into environmental variables (system factors) and internal variables (human factors), as shown in Figure 4-1.

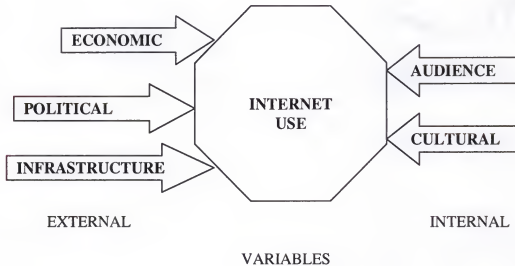


Figure 4-1. Graphic model.

The environmental variables (system factors) include the economic variable (GNP per capita), the political climate and policy variables (democratization and telecommunications privatization), and the infrastructure variable (teledensity). The internal variables (human factors) include the audience variables (educational level and English language proficiency) and the cultural variable (predominant religion). In essence, the internal variables are “embedded” in the individual Internet user while the

external environment variables are conceptualized as factors outside the individual. Thus Internet usage is determined by the audience's internal characteristics as well as system factors existing externally.

### **Statistical Procedures**

Multiple regression is the main method employed in this study. The basic assumptions of regression analysis are reviewed briefly below.

#### **Multiple Regression Technique**

Regression analysis is a type of a multivariate technique that measures relationships among a set of variables, and is a popular method in social science research (Kleinbaum et al., 1988). It allows researchers to evaluate the relationship between a single, continuous dependent variable and one or more independent variables. As Kleinbaum et al. (1988) note, there are five basic assumptions in linear regression:

1. Y is a random variable, with a probability distribution with a finite mean and variance for any fixed value of the independent variable  $X_i$

In this study, the observations included in the analysis constitute the population of interest. Thus, the dependent variable--Internet users per 10,000 population--is not a random variable per se. However, it can be argued that it is a random sample where each country's probability of being picked equals 1. Therefore, we can treat the dependent variable as having a probability distribution with a finite mean and variance for the values of the independent variables.

2. Independence: Y follows a normal distribution, and the Y-values are statistically independent from one another

It is logical to expect that in this model the dependent variable will follow a normal distribution after a logarithmic transformation because the gaps between the Ys increase as Y increases. It is also expected that the number of Internet users per capita in country

A will not affect the Internet users per capita in country B, i.e., the values of the dependent variable will be statistically independent. Both of these assumptions will be tested empirically.

3. Linearity: Y is a linear function of X (i.e., the mean value of Y is a straight line in regard to X)

This assumption states that the relationship between the dependent variable and the independent variables is linear. The assumption is likely to hold true in this model based on previous research and also on a brief look at the data. As GNP increases, the number of Internet users also increases. Again, the validity of the assumption will be tested both visually and statistically in the next chapter.

4. Homoscedasticity: The variance of Y is the same for any value of X

Another important assumption in regression analysis is that the dependent variable will have the same variance for each value of X. Violations of homoscedasticity--i.e., heteroscedasticity, often occur in conjunction with violations in the normal distribution. Therefore, it is expected that the dependent variable will exhibit equal variances if it is normally distributed.

5. Distribution: For every fixed value of  $X_i$ ,  $Y_i$  is normally distributed

The final assumption is that the distribution of the Ys will be normal respective to the X values. There is no reason to expect violations in the distribution of the residuals.

In regression, the so-called least squares method "determines the best-fitting straight line as that line which minimizes the sum of squares" of the residuals (Kleinbaum et al., 1988, 49). Thus, regression analysis allows for estimation of both the direction and strength of the relationship between variables.

The model proposed here is that the dependent variable  $Y$  (number of Internet users) is a function of ECON, POLI, TECH, AUD, and CUL factors:

$$Y = f[\text{ECON, POLI, TECH, AUD, and CUL}]$$

It is expected that the regression model follows the basic regression formula  $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i$ , where  $\alpha$  is the intercept and the  $\beta$  is the slope of the regression line. The  $X$ s represent the independent variables/predictors. Clearly, when all the  $X$ s equal zero,  $Y = \alpha$ . When  $X_1$  increases by 1 (controlling for the other predictors), the mean of  $Y$  increases by  $\beta_1$ . When changes in the values of  $X_i$  have no effect on the mean of  $Y$ , then  $\beta_i = 0$ . It is inferred then that there is no relationship between the dependent and independent variables.

Multiple regression is the best method to answer the question: What are the most significant predictors of the variable  $Y$ ? One of the advantages of multiple regression is that it allows researchers to detect the relationship between  $X$  and  $Y$  while controlling for a subset of other predictors. In other words, the partial contribution of the variable  $X$  can be measured when other covariates are included in the regression model. Regression generally looks for a linear association between the variables. It tries to fit the  $Y$  values on a regression line by minimizing the (squared) distances between the observed value  $Y_i$  and the predicted value of  $Y$ .

The goal in regression analysis is to explain as much of the variation of  $Y$  as possible. It is tested whether the regression function--using the combination of the  $X$ s--will explain more of the variation in  $Y$  than only using the mean of  $Y$ . The amount of variation explained is expressed in an R-square value. The R-square value ranges between 0 and 1. The closer the R-square value is to 1, the more of the total variation in

Y is explained by the regression model. Since this analytical model is more comprehensive than previous research, it is expected that the R-square will be high. No direct comparisons of the R-square value will be possible, however, because no study to date has examined Internet use in the same set of countries.

### **Stepwise Regression**

Several automatic selection procedures exist that help reduce the number of explanatory variables to be used in a regression model. These include backward and forward selection methods. Such stepwise regression methods allow researchers to select a subset of the initial set of explanatory variables. That technique is especially useful for exploratory research (Stevens, 1992). Forward stepwise regression begins by entering the predictor that has the strongest partial contribution to the dependent variable Y. At each subsequent step, another predictor is entered. The backward stepwise method is the opposite: all explanatory variables are initially entered in the model. Variables that lose statistical significance after entering the regression model are removed (in contrast to forward selection where predictors, once included, cannot be removed from the model).

Backward regression was chosen as a stepwise method. First, all explanatory variables will be entered into the model. Next, the backward selection procedure will remove the variable with least partial contribution to the dependent variable Y. Therefore, any of the predictors may be removed as insignificant from the final model at subsequent steps. The criterion for removal will be F-test probability larger than .10. Also, the backward regression procedure is set up so that variables removed earlier do not reenter the model at subsequent steps. In this study, we begin by including all predictors in the regression model. This complete model is used to test the proposed hypotheses. Next, variables will be removed one by one, using backward regression. Thus, a final model in

which all explanatory variables are statistically significant will be derived. Comparisons between the complete model and the reduced/ final model are offered based on R-square and Adjusted R-square values.

Thus, backward regression is used to select the most important explanatory variables for the final regression model. This statistical procedure, even though hardly a panacea, also reduces the problem of multicollinearity as variables that do not bring individual contributions (in other words, do not explain additional variation of Y) are removed. However, it is important to note that stepwise regression has some inherent issues as a regression type. The use of stepwise regression here is only justified by the fact that this is an exploratory study.

### **Hypotheses**

Based on the literature review, the following hypotheses are formulated and empirically tested, as reported in Chapter 5.

#### **Proposition 1**

Internet adoption in the post-communist countries will increase over time. Based on diffusion trends in other regions of the world--and particularly in Western Europe--we expect steady growth in the number of Internet users.

Hypothesis 1: The number of Internet users per capita in the post-communist countries increased from 1995 to 1999.

Test: Paired-samples T-test for comparison of means:  $Y_{1995} < Y_{1999}$

#### **Proposition 2**

Economic factors play a critical role as a driving force of Internet adoption. A higher level of economic development will result in higher Internet penetration within the

post-communist countries. The key indicator of economic development is GNP per capita. Thus,

Hypothesis 2: The higher the level of PPP GNP per capita, the higher the number of Internet users per capita.

Test:  $H_A: \beta_1 > 0$

### **Proposition 3**

Restrictive telecommunications policies and lower levels of democratization will result in lower Internet diffusion. Conversely, more political freedom and faster liberalization in the telecommunications sector will encourage further Internet development.

Hypothesis 3a: The higher the level of civil liberties, the higher the number of Internet users per capita. (The civil liberties score will be reversed to show a positive association.)

Test:  $H_A: \beta_2 > 0$

Hypothesis 3b: The longer the period of telecommunications privatization, the higher the number of Internet users per capita.

Test:  $H_A: \beta_3 > 0$

### **Proposition 4**

More developed technology infrastructure will lead to greater levels of Internet usage within the post-communist countries. Teledensity is the most critical infrastructure determinant of Internet use. Thus,

Hypothesis 4: The higher the teledensity in the country, the higher the number of Internet users per capita.

Test:  $H_A: \beta_4 > 0$

### **Proposition 5**

Audience characteristics, including education level and English language proficiency, affect the levels of Internet usage in the post-communist countries.<sup>8</sup>

Hypothesis 5: The higher the tertiary education ratio, the higher the number of Internet users per capita.

Test:  $H_A: \beta_5 > 0$

### **Proposition 6**

Cultural predispositions affect the level of Internet use within the post-communist countries. Dominant religion, as a major cultural factor, will affect Internet penetration.

Hypothesis 6: Differences in national religion will affect the number of Internet users per capita.

Test:  $H_A: \beta_6 \neq 0; \beta_7 \neq 0$

### **Methodological Notes**

Multivariate quantitative studies often face the issue of high correlation between the explanatory variables. In such cases, reduction of variables is probably the best solution (Agresti & Finley, 1997; Stevens, 1992). Variable reduction is especially desirable in this study, where a large number of predictors and a small number of observations are examined.

The population of this study includes the countries of Eastern Europe, the former Soviet Union, and Mongolia. The unit of analysis is the country. Statistical analysis will allow us to make inferences about the relationships between the dependent variable and a

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<sup>8</sup> Due to lack of language data, the effects of English language proficiency on Internet adoption cannot be tested.

number of independent variables. Parameters will be estimated and hypotheses tested in the following chapter.

The number of observations in this statistical analysis is relatively small ( $N=28$ ). The specific set of countries includes: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia (FYROM), Moldova, Mongolia, Poland, Romania, the Russian Federation, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Yugoslavia (Serbia and Montenegro).

The relatively small number of observations is justifiable considering (1) the exploratory nature of this study, (2) the strong theoretical base, (3) the comprehensiveness of the model, and (4) the fact that it includes the population of interest. The independent variables chosen have been identified as significant Internet determinants in prior studies of cross-country Internet diffusion. There is very little research on Internet adoption in the post-communist countries. Finally, the issues of sampling do not apply here as the total number of countries--i.e., the entire population of interest--is included in the study. Therefore, the results of this study cannot be criticized because the observations include the entire population of interest, namely all the post-communist countries.

The dependent variable in this analysis has an interesting feature: It cannot take on negative values. Clearly, the lower end of the variable--number of Internet users--is zero. Such variables are called truncated. Some econometric literature suggests that using classical linear regression for such dependent variables may produce biased results (Gujarati, 1995; Maddala, 1984; Tobin, 1958). In simple terms, the bias comes from the

fact that the assumption of equal variance of the dependent variable across all values of the independent variables is violated when the values of the dependent variable approach zero (Maddala, 1984). In such cases an alternative procedure called Tobit is recommended. Using linear regression with truncated dependent variables is not a problem when only few of the values are close to zero, however. In this study, the lowest number of Internet users per 10,000 population is 3.13 for Uzbekistan. Only three countries (Uzbekistan, Tajikistan, and Turkmenistan) have less than 5 Internet users per 10,000 population.

In a study of worldwide Internet diffusion, Beilock and Dimitrova (2003) found that the results of the two methods--Tobit and multiple regression--were, in effect, identical. Tobit himself suggests that the results of the regression analysis are a close approximation of the results produced by Tobit analysis (Tobin, 1958). In this particular study, there is enough variability across the values of Y to assume that multiple regression will produce unbiased estimates. The statistical tests for homoscedasticity show no serious violation. Still, a Tobit analysis will be conducted as an additional step to check the coefficient estimates of the regression against the Tobit estimates.

Another limitation in this study is the problem of multicollinearity. Multicollinearity is evident across the bivariate correlations between the explanatory variables (See Table 4-2). As expected, multicollinearity exists in several cases: more affluent societies tend to have more developed telecommunications infrastructure ( $r=.84$ ); teledensity is also highly correlated with the level of democratization ( $r=.72$ ) and length privatization ( $r=.55$ ). However, it will not be appropriate to eliminate variables identified in the literature as significant only because of potential multicollinearity issues.

The multicollinearity problem is strongest between GNP per capita and teledensity. The implication of such multicollinearity is that these two variables, if entered together in the model, will affect each other's significance. However, the overall significance of the F-test is uncompromized. Further, the stepwise regression method will partially take care of the multicollinearity problem because variables that do not independently add to the R-square will be removed from the regression equation.

Table 4-2. Correlation matrix for the continuous independent variables.

Variable	lnGNP	TEL	PRIV	DEM
TEL	.84			
PRIV	.43	.55		
DEM	.56	.72	.39	
EDU	.36	.40	.23	.09

This study measures Internet adoption at a single point in time, except for Proposition 1. The five-dimensional framework proposed here is tested by Hypotheses 1 through 6 examines the relationship between Internet use and a set of explanatory variables at one point in time. Thus, this study is cross-sectional, which limits the applicability of the findings for future stages of Internet diffusion.

Another methodological concern is the use of proxies. Data unavailability makes it necessary to include proxy variables for a number of factors identified in the literature review. In particular, it is very difficult to measure culture empirically. Admittedly, religion is only one characteristic of cultural differences.

The data on Internet users per capita--my dependent variable --need to be considered an approximation, an estimate of the actual number of Internet users in the country. However, these are the best data on Internet use available at the time of this

research. Again, these numbers are best estimates and are more useful for comparison purposes rather than in absolute terms. The concluding chapter offers more discussion on the limitations of this study.

Finally, it is important to note the following changes in terminology took place while this study was being conducted: The country of Yugoslavia has a new official name. The new name adopted in March 2002 is Serbia and Montenegro. Also, GNP is now called GNI (Gross National Income), according to the World Bank. This new label was adopted in 2001. For the purposes of this manuscript, however, the two original names are used.

Next, Chapter 5 describes the results of the statistical analysis and the hypothesis testing.

## CHAPTER 5

### RESULTS

The main goal of this study was to identify the most significant predictors of Internet adoption in the post-communist countries. A t-test, multiple regression, and Tobit analysis were performed to test the hypotheses proposed in the previous chapter. The results showed that by applying the five-dimensional framework, a significant portion of the variation in Internet use was explained. Before looking at the hypothesis testing, descriptive statistics of this study are presented next.

#### **Descriptive Analysis**

##### **Internet Users**

The dependent variable used in this study was Internet users per 10,000 population (IUR). This indicator is reported by the International Telecommunication Union (ITU) as the estimated number of Internet users in the country, per 10,000 population. In this study, the variable is log-transformed, using natural logarithm as a base, because the distribution of the raw variable is skewed. This logarithmic transformation was performed to alleviate the violation of the normality regression assumption. Variations in the dependent variable are described below. It is important to note that when data have been log-transformed, the regression slope indicates a ratio of change in the dependent variable. Therefore, the regression coefficients below reflect a percent change in IUR.

The range for the transformed dependent variable  $\ln IUR$  (Log of Internet users per 10,000) shows a nice dispersion. For easier interpretation, the raw (non-logged) numbers are discussed here. Table 5-1 shows that the country with the highest number of Internet

users per 10,000 people is Estonia (Ranked #1). It has 1,383.5 users per 10,000 population, followed by the Slovak Republic (#2) with 1,300.7 users, and Slovenia (#3) with 1,257.0. These countries are the Internet leaders among the former Soviet bloc countries. The Czech Republic (#4), Hungary (#5), and Poland (#6) rank next. At the other end of the spectrum, data show Uzbekistan with 3.1 users per 10,000 population (as #28 at the bottom), preceded by Tajikistan (#27) with 3.3, and Turkmenistan (#26) with 4.6. These countries are the laggards in Internet adoption in the post-communist world. The other three countries with fewer than 10 users per 10,000 population are Albania (#25), Bosnia and Herzegovina (#24), and Belarus (#23).

There is clearly a wide disparity between the leaders and the laggards in Internet adoption among the post-communist countries. The difference between Estonia at the top of the ranking and Uzbekistan at the bottom is more than 400 times. Even a country in the middle of the ranking such as Romania (#10) has 70 times more Internet users per 10,000 population than Uzbekistan (#28). Two republics of the former Soviet Union show similar discrepancies: Russia (#12) has 19 times the Internet use of Belarus (#23). The degree of difference between Kazakhstan and Belarus is smaller but still substantial: Kazakhstan has over 4 times the number Internet users of Belarus.

The mean for the non-logged values of Internet users per 10,000 population is 290.85 and the median--the middle value--is 80.16, which indicates right-skewed distribution. The percentiles show that 25 percent of the data points are under 10.66 and 25 percent are above 442.65 Internet users per 10,000 people, with Inter Quartile Range of 433.99. The logged values range from .50 to 3.14, with a mean of 1.88 and standard deviation of .85, as shown in Table 5-2.

Table 5-1. Internet users per 10,000 people in 1999.

Rank	Country	Internet Users
1	Estonia	1383.5
2	Slovak Republic	1300.7
3	Slovenia	1257.0
4	Czech Republic	682.1
5	Hungary	587.7
6	Poland	542.1
7	Croatia	446.7
8	Latvia	430.4
9	Lithuania	278.3
10	Romania	267.8
11	Bulgaria	241.6
12	Russian Federation	183.4
13	Macedonia, FYR	149.2
14	Armenia	85.1
15	Yugoslavia, FR	75.2
16	Kazakhstan	43.0
17	Ukraine	39.5
18	Georgia	36.7
19	Moldova	34.3
20	Kyrgyz Republic	21.4
21	Mongolia	11.1
22	Azerbaijan	10.4
23	Belarus	9.7
24	Bosnia and Herzegovina	9.1
25	Albania	6.5
26	Turkmenistan	4.6
27	Tajikistan	3.3
28	Uzbekistan	3.1

Source: ITU, 2000.

### Gross National Product

Gross National Product (GNP) per capita was used as a predictor variable.

Differences between GNP and GDP are typically relatively small and the two indicators are often used interchangeably. GNP is defined by the World Banks' World Development Indicators as the total amount of domestic and foreign value added claimed by residents.

The specific variable used here is GNP in terms of purchasing power parity (PPP GNP), the U.S. dollar value of the goods and services that can be purchased within the country

using individual income in the local currency. In the post-communist countries, GNP varies from a low of \$1,041 for Tajikistan to a high of \$14,400 for Slovenia. Again, the relative differences show a considerable gap between top and bottom country in the region. Because of its skewed distribution, the GNP is log transformed, using natural logarithm as a base. The logged values for this variable--lnGNP--range from 6.95 to 9.57 (See Table 5-2).

Table 5-2. Descriptive statistics of variables.

	Minimum	Maximum	Mean	St. Deviation
lnIUR <sup>a,b</sup>	.50	3.14	1.88	.85
lnGNP <sup>c,d</sup>	6.95	9.57	8.37	.65
DEM	1	6	4.21	1.55
PRIV	0	9	1.71	2.72
TEL <sup>e</sup>	32	513	226.79	148.04
EDU	11	45	27.72	10.07
Religion <sup>f</sup>	Eastern Orthodox (EST) Western Christian (WST) Muslim (MSL)			Frequency 10 9 9

a. IUR has been natural-logged.

b. See Chapter 4 (Methods) for complete description of variables and data sources.

c. This is a GNP PPP per capita measure and it has been natural-logged.

d. Due to lack of data, per capita figures for Yugoslavia (Serbia and Montenegro) are based on Macedonia figures.

e. Teledensity combines both residential and mobile phones.

f. Mongolia was coded as Muslim due to its cultural similarity with this group.

## Democratization

A proxy for the level of democratization in the country is the Freedom House ranking of civil liberties. The civil liberties scores range from 1 to 7. The variable used in this study, DEM, was based on a reversed ranking of the Freedom Forum score. In this study, a value of 1 means "Not Free" and a value of 7 reflects a "Free" country.

Variations across this predictor variable range from 1 to 6. In other words, none of the 28

countries in the model is ranked as completely free, according to the Freedom House Foundation data. However, nine countries received a ranking of 6, Almost Free. Only one country--Turkmenistan--received a ranking of 1, Not Free. Note that civil liberties is, in essence, an ordinal variable, but it is treated as interval in this analysis as noted in the Methods chapter.

### **Telecommunications Privatization**

Telecommunications privatization was measured as the number of years since the incumbent telecommunications operator has been privatized, either fully or partially, at the end of 1999. There is relatively little variation across this variable. Several of the countries of interest have been rather slow in privatizing their major telecom operator. Specifically, the telecom privatization variable equals zero in 17 (or 61 percent) of the cases. The country that privatized its operator first was Estonia, followed by Hungary and Latvia. The majority of countries, however, have not yet privatized or did so very recently. This lack of variation may reduce the potential significance of the variable in the regression testing.

### **Teledensity**

The infrastructure variable was constructed by adding the number of mobile phones per 1,000 population to the number of residential phones per 1,000 population. Not surprisingly, data vary widely across the population of the study. As shown in Table 5-2, the mean teledensity for the 28 countries is 226.79 phones (mobile and residential) per 1,000 population. The number for Albania is 32 (lowest teledensity in the region) in contrast to Estonia where telephone penetration was 513 (highest teledensity in the region).

### **Education**

Education was measured by the tertiary education ratio, using data from the World Development Indicators database. This variable shows how many people from the relevant age group attended college. There is relatively little variation across this variable: the mean for all countries was 27.72, with standard deviation of 10.07 (See Table 5-2). The top country with a ratio of 45 is Estonia whereas Albania is at the bottom of the list with a ratio of 11.

### **Religion**

Predominant religion was used as a cultural determinant. The frequencies show that nine of the post-communist countries are predominantly Western Christian (Catholic or Protestant), ten countries are predominantly Eastern Orthodox Christian, and nine are predominantly Muslim/Buddhist. Mongolia is a predominantly Buddhist country, but it was coded as Muslim, based on Fish (1998), due to its cultural similarity to this group. To test the proposed hypothesis, two dummy variables were constructed. Western Christian (Catholic or Protestant) was coded as 1 and 0 otherwise in the first dummy variable. In the second dummy variable, a country was coded as 1 if predominantly Muslim or Buddhist and 0 otherwise. Thus, Eastern Orthodox Christianity was the 0 category for religion.

### **Bivariate Correlations**

Next, bivariate correlations between the dependent variable--log of Internet users per 10,000 population--and the set of independent variable, excluding the religion dummies, were run. The Pearson correlations are shown in Table 5-3. The variable with the highest bivariate correlation coefficient is teledensity, followed by democratization. Both of these variables are highly correlated with lniur and both coefficients are well

above .80 whereas the correlation with lnGNP is close to .80. The bivariate correlation coefficients are lower for telecommunications privatization ( $r=.50$ ) and education ( $r=.25$ ). All coefficients are positive, indicating a positive relationship between IUR and the predictors, without controlling for the other variables.

Table 5-3. Pearson correlations between dependent and independent variables.

Variable	lnIUR
lnGNP	.795
DEM	.843
PRIV	.503
TEL	.895
EDU	.245

After initial examination of the bivariate correlations, a multivariate regression was conducted. The results of the multiple regression analysis are presented in the next section.

## Regression Results

### Statistical Assumptions

The classical assumptions of linear regression are: first, a linear relationship between the dependent variable and the determinants; second, homoscedasticity (or equal variance of Y for all Xs); and third, normal distribution of the dependent variable across the values of the independent variables. All of these assumptions are satisfied in this analysis, either initially or after subsequent transformation of variables. An examination of the histograms as well as statistical tests showed no significant deviations.

Internet Users in the Post-Communist Countries

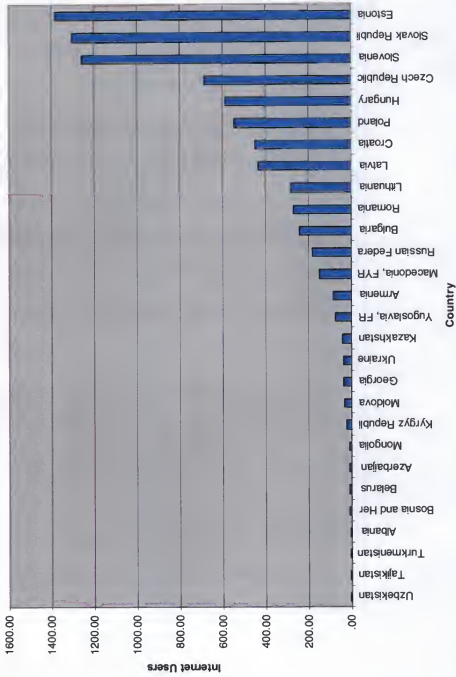


Figure 5-1. Distribution of Internet users across countries.

## Hypotheses Testing

The five-dimensional theoretical framework proposed the following function:  $Y = f$  [ECON, POLI, TECH, AUD, and CUL], where the dependent variable  $Y$  is the number of Internet users per capita.  $Y$  was defined as a function of economic, political climate and policy, technology, audience, and cultural factors. The specific hypotheses stated on the basis of this function are tested below.

Hypothesis 1 predicted that the average number of Internet users in the region increased significantly from 1995 to 1999. A paired-samples  $t$ -test for comparison of means was performed. Due to lack of data for 1995, only 19 countries are included. The results of the  $t$ -test comparing Internet use in 1995 and 1999 are significant ( $t_{(18)} = 3.07$ ;  $p = .007$ ). The  $t$ -statistic is positive, which indicates that the number of Internet users increased significantly from 1995 to 1999. Thus, hypothesis one is supported.

Despite the general increase in the number of Internet users in 1999, variations across the post-communist countries remained stark. Figure 5-1 shows the unequal distribution of Internet users per capita based on 1999 data. It is obvious that the degree of difference in Internet use between the countries in the region is substantial, with three countries clearly at the top: Estonia, the Slovak Republic, and Slovenia.

The second hypothesis predicted that higher per capita income would contribute to higher number of Internet users per capita. Table 5-4, Model 1 shows the results of the multiple regression analysis. The results indicate that this hypothesis is supported. The standardized beta coefficient for GNP ( $B = .23$ ,  $p = .031$ ) is positive and statistically significant at the .05 level (See Table 5-4, Model 1). As expected, higher  $\ln$ GNP leads to higher  $\ln$ IUR.

The third hypothesis predicted a positive relationship between the political and policy variables and Internet adoption levels. Hypothesis 3a stated that the higher the level of civil liberties in the country, the higher the number of Internet users per capita. The results of the regression analysis show support for this relationship. As Table 5-4, Model 1 illustrates, the standardized beta coefficient for DEM is positive and statistically significant ( $B=.36, p=.001$ ). Thus, the regression results show strong support for this hypothesis.

Table 5-4. Regression results for Internet users.<sup>a, b, c, d</sup>

Variable	Model 1	Model 2	Model 3	Model 4
lnGNP	.23* [.031]	.23* [.027]	.22* [.033]	.22* [.036]
DEM	.36*** [.001]	.36*** [.000]	.36*** [.000]	.41*** [.000]
PRIV	.09 [.141]	.09 [.135]	--	--
TEL	.24 [.148]	.25 [.074]	.32* [.025]	.28* [.039]
EDU	-.10 [.115]	-.10 [.099]	-.10 [.115]	--
WST	.01 [.471]	--	--	--
MSL	-.26* [.016]	-.26** [.008]	-.28* [.014]	-.20* [.024]
R-Square	.923	.923	.918	.912
Adjusted R-Square	.896	.901	.899	.897
F-test [Sign.]	34.107 [.000]	41.768 [.000]	49.226 [.000]	59.773 [.000]

a. Dependent variable: Log of Internet users.

b. The table reports Standardized Beta Coefficients with significance in brackets.

c. The coefficients are based on one-tailed tests.

d. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Hypothesis 3b proposed that the longer the period of telecommunications privatization, the higher the number of Internet users per capita. Even though the coefficient for PRIV is positive, this variable is not statistically significant ( $B=.09$ ,

$p=.141$ ). Thus, we cannot reject the Null hypothesis that  $\beta_3$  is larger than 0. Hypothesis 3b is not supported, as shown in Table 5-4, Model 1.

Hypothesis 4 predicted that higher teledensity in the country will lead to higher Internet use per capita. Even though the sign of the beta coefficient is positive ( $B=.24$ ,  $p=.148$ ), the partial t-test in the regression table is not significant at the 95 percent confidence level (Table 5-4, Model 1). Thus, the results of the regression analysis show no support for Hypothesis 4.

The results of the regression analysis do not support Hypothesis 5 either. Higher tertiary education ratio seems to be related to lower number of Internet users per capita ( $B=-.10$ ,  $p=.115$ ). However, the results for this predictor are not significant (See Table 5-4, Model 1). Thus, we cannot reject the Null hypothesis and conclude that educational level is not positively related to Internet use.

The last hypothesis predicted that differences in the predominant national religion would affect the number of Internet users per capita. The results of the regression analysis show partial support for Hypothesis 6, as reported in Table 5-4, Model 1. The standardized beta coefficient for the Muslim dummy variable is negative and statistically significant ( $B=-.26$ ,  $p=.016$ ) whereas the coefficient for the Western Christian group is not significant ( $B=.01$ ,  $p=.47$ ). Thus we conclude that Muslim religion is significantly and inversely related to Internet use, but Western Christianity is not, when examining the post-communist countries. Bear in mind that the values of the religion dummies are relative to Eastern Orthodox as the base and do not represent absolute values.

The most surprising result is that teledensity is not statistically significant in the complete regression model. This could be partially due to the high correlation between

TEL and GNP. Another possible explanation for the lack of significance of TEL is that the countries in the region are relatively close in terms of existing infrastructure, compared with countries in sub-Saharan Africa and Western Europe, for example. Teledensity may not be a constraint for Internet use in the post-communist countries. Further analysis was performed to determine which explanation is more plausible. Only income, democratization, and Muslim religion are statistically significant in the full regression model.

Table 5-5. Summary of hypothesis testing.

Hypothesis	Statement	Result
H1	The percent of Internet users in the post-communist countries increased from 1995 to 1999.	Supported
H2	The higher the level of PPP GNP per capita, the higher the number of Internet users per capita.	Supported
H3a	The higher the level of civil liberties, the higher the number of Internet users per capita.	Supported
H3b	The longer the period of telecommunications privatization, the higher the number of Internet users per capita.	Not Supported
H4	The higher the teledensity in the country, the higher the number of Internet users per capita.	Not Supported
H5	The higher the tertiary education ratio, the higher the number of Internet users per capita.	Not Supported
H6	Differences in national religion will affect the number of Internet users per capita.	Partially supported

The results of the multiple regression analysis show that the six predictors combined explain 92 percent of the variation in Internet use (See Table 5-4, Model 1). The adjusted R-square is .896, which is also substantial. Three of the predictors in the complete model--GNP, DEM, and MSL--are significant at the .05 probability level. However, the other four predictors--PRIV, TEL, EDU, and WST-- are not statistically significant. Therefore, subsequent regression models are developed to determine the most robust model for these data.

### Final Model

Backward regression was employed to determine the best regression model, the one employing the fewest predictors and having the strongest explanatory power. Adjusted R-square values were used as a criterion, with higher Adjusted R-square indicating a better model. At each step, the backward regression procedure removed the variable with the least contribution from the complete model. The criterion used to delete variables was F-test probability higher than .10. Using this procedure, the first variable to leave the model was Western Christian religion (See Table 5-4, Model 2). At the next step the telecommunications privatization variable was removed (Table 5-4, Model 3). Next, tertiary education ratio was removed (Table 5-4, Model 4), with income, democratization, teledensity, and Muslim religion remaining in the model. Of the seven initial variables, only four were left in the reduced final model.

The four predictors that remained in the final regression model were income (lnGNP), democratization (DEM), teledensity (TEL), and Muslim religion (MSL). These four predictors, collectively, explain 91 percent of the variation in Internet use. The adjusted R-square for the final model is .897, which is slightly higher than the value in the complete model. It is also evident that the F-test from Model 1 (complete model) to Model 4 (final model) increased. The ANOVA tables for the each of the four regression models are presented below with a comparative discussion.

The complete model of the multiple regression is shown in Table 5-6. Based on this model, the following regression equation line is derived:

$$\ln IUR = -1.458 + .302 \ln GNP + .195 DEM + .027 PRIV + .001 TEL - .008 EDU + .020 WST - .462 MSL + \epsilon$$

Table 5-6. ANOVA Table for Complete Model.<sup>a, b, c</sup>

Model 1	Beta	Std. Error	Std. Beta	t	Sig.
Constant	-1.458	1.219		-1.196	.246
lnGNP	.302	.152	.231	1.983	.061
DEM	.195	.056	.357	3.502	.002
PRIV	.027	.024	.086	1.109	.281
TEL	.001	.001	.235	1.070	.297
EDU <sup>d, e</sup>	-.008	.006	-.096	-1.241	.229
WST <sup>f</sup>	.020	.260	.011	.075	.941
MSL	-.462	.201	-.259	-2.302	.032

a. Dependent Variable: Log Internet users

b. N=28

c. Two-tailed

d. Because education was not showing a significant effect, and we suspected some indirect relationship with GNP for that, the GNP variable was removed from the model and all coefficients were recalculated. However, neither the size nor the direction of the coefficient for education changed.

e. Instead of tertiary education ratio, high school education was used as an alternative education measure. However, the coefficient remained negative and insignificant.

f. Because Western Christian religion (WST) was not showing a significant effect, and we suspected some indirect relationship with Western Christianity and teledensity. Therefore, the teledensity variable was removed from the model and all coefficients were recalculated. However, the WST variable remained insignificant.

The equation for the complete regression model shows that one percent increase in national GNP leads to .30 percent increase in IUR since both the dependent variable IUR and the income variable GNP have been logged. An increase by 1 in the civil liberties score results in a .195 percent increase in Internet users per 10,000 population. If privatization is a year longer, that leads to a .027 percent increased in IUR given that the other variables are held constant. Adding one unit to teledensity increases the mean of IUR slightly by .001 percent. Increasing education by one unit leads to a .008 percent decrease in the mean of IUR. Being predominantly Western Christian leads to .02 percent increase in IUR. On other hand, being a predominantly Muslim society leads to a .462 percent decrease in the number of Internet users per 10,000 population.

Table 5-7. ANOVA Table for Model 2.<sup>a, b, c</sup>

Model 2	Beta	Std. Error	Std. Beta	t	Sig.
Constant	-1.479	1.158		-1.277	.215
lnGNP	.303	.148	.232	2.051	.053
DEM	.197	.052	.359	3.773	.001
PRIV	.027	.023	.085	1.134	.270
TEL	.001	.001	.245	1.497	.149
EDU	-.008	.006	-.097	-1.332	.197
MSL	-.455	.175	-.255	-2.601	.017

a. Dependent Variable: Log Internet users

b. N=28

c. Two-tailed

The second model includes only six variables since the first step of the backward selection procedure removed the Western Christianity variable. There are only minor changes in the regression coefficients from Model 1 to Model 2. The only change worth noting is the increased significance of MSL after the removal of WST. The overall R-square for Model 2 remains .92 while the adjusted R-square increases from .896 to .901 (See Table 5-4, Model 2). This was expected because of the reduced number of variables in Model 2.

At the next step of the backward selection procedure, the telecommunications privatization variable was removed. The ANOVA table for Model 3 (Table 5-8) shows that the two strongest determinants seem to be democratization and teledensity, as indicated by their standardized beta coefficients. The R-square of the regression model goes down slightly (from .923 in Model 2 to .918 in Model 3) as does the adjusted R-square (from .901 in Model 2 to .899 in Model 3). Still, more than 90 percent of the variation in Internet users is explained by the present model. The adjusted R-square also remains high.

Table 5-8. ANOVA Table for Model 3.<sup>a, b, c</sup>

Model 3	Beta	Std. Error	Std. Beta	t	Sig.
Constant	-1.444	1.165		-1.240	.228
lnGNP	.289	.148	.221	1.946	.065
DEM	.199	.052	.363	3.794	.001
TEL	.002	.001	.317	2.085	.049
EDU	-.008	.006	-.090	-1.237	.229
MSL	-.347	.166	-.195	-2.096	.047

a. Dependent Variable: Log Internet users

b. N=28

c. Two-tailed

The final model is derived through removing the tertiary education variable using the backward selection procedure. Table 5-9 shows the ANOVA table for the final model, Model 4. Western Christian religion, telecom privatization, and education have been removed from the complete regression model. Thus, the four determinants left in the reduced model are income, democratization, teledensity, and Muslim religion. The standardized beta coefficients indicate that democratization is most influential among those, followed by teledensity, national income, and Muslim religion. This final model, Model 4, has an R-square of .912 and an Adjusted R-square value of .897. The final model also has the most significant F-test ( $F=59.77$ ,  $p=.000$ ) as shown in Table 5-4, Model 4. The regression line derived from Model 4 is the following:

$$\ln IUR = -1.683 + .284 \ln GNP + .222 DEM + .002 TEL - .347 MSL + \varepsilon$$

Interpreting the partial effects of the four remaining variables, it is clear that one percent increase in national GNP leads to a .284 percent increase in IUR. An increase by 1 in the civil liberties score results in a .222 percent increase in Internet users per 10,000 population. Similarly, an increase by 1 in teledensity increases the mean of IUR by .002 percent. Finally, being a predominantly Muslim country leads to .347 percent decrease in the number of Internet users.

Table 5-9. ANOVA Table for Model 4. <sup>a, b, c</sup>

Model 4	Beta	Std. Error	Std. Beta	t	Sig.
Constant	-1.683	1.162		-1.448	.161
lnGNP	.284	.150	.217	1.896	.071
DEM	.222	.050	.405	4.480	.000
TEL	.002	.001	.276	1.841	.078
MSL	-.347	.166	-.195	-2.096	.047

a. Dependent Variable: Log Internet users

b. N=28

c. Two-tailed

Which of the four models presented above should be selected as the best model?

The second model, which included all predictors except the Western Christianity variable removed at the first step of the backward selection procedure, had the highest adjusted R-square. If we only look at adjusted R-square value then, Model 2 should be considered superior to Model 4. The final model--Model 4, however, is more parsimonious, as it includes fewer predictors and explains almost as much of the variation in IUR as Model 2. In fact, the F-tests for Model 4 is highest compared to the previous regression models. Based on the F-test statistic, we conclude that the final model--Model 4--could be seen as better than the previous regression models.

The results of the final regression model, again, were derived by a backward selection procedure so once a variable was removed, it did not come back into the model. Thus, multicollinearity among variables may have affected the selection order of the remaining variables. The backward regression, however, helped select the most significant determinants of Internet use in the post-communist countries. Due to multicollinearity, the individual beta coefficients in the multiple regression analysis should be interpreted with caution. However, multicollinearity does not jeopardize the

explanatory power of the overall model. Limitations of the study are addressed in the concluding chapter.

Among the seven independent variables, income and teledensity are the two variables most highly correlated. Putting them together in one model raises the question whether there is some indirect relationship between the two variables. However, previous literature shows that both factors are important, which makes it necessary to include both variables in the model. A possible indirect relationship between income and teledensity can be expected. However, a study found that adding an interaction term for these two variables did not matter (Dimitrova, In press).

### **Tobit Estimates**

The dependent variable in this study--number of Internet users--cannot take on negative values. Therefore, IUR is a truncated variable and invites the use of a different statistical analysis (Maddala, 1984; Tobin, 1958). Even though there are no serious violations of the equal variances assumption in IUR, it is still helpful to conduct a Tobit analysis on the same data in order to validate the regression results. Therefore, a Tobit estimates were conducted on the final model derived from the backward regression. The results of the Tobit analysis are presented in Table 5-10.

The Tobit estimates presented in Table 5-10 show that all predictors in the final model remained statistically significant. The Chi-square value was highest for the democratization variable, followed by Muslim religion, GNP per capita, and teledensity. The relative magnitude of the Chi-square values resembles closely that of the t-statistics in the multiple regression analysis while the significance of the predictor variables is even higher.

Table 5-10. Tobit estimates for final model. <sup>a, b, c</sup>

Model 4	Beta	Std. Error	Chi-square	Sig.
Constant	-1.671	1.051	2.528	.112
lnGNP	.283	.136	4.353	.037
DEM	.221	.045	24.386	.000
TEL	.002	.001	4.233	.040
MSL	-.346	.150	5.316	.021

a. The table reports Tobit estimates with Chi-square values and probability levels in last column.

b. Dependent Variable: Log Internet users

c. N=28

As expected, the regression coefficients and the coefficients in the Tobit analysis remained almost identical. However, the Tobit table reveals that the standard errors for the coefficient estimates went down, including both the intercept and the other four variables. The probability levels also went down, compared with the p-values of the final regression table, indicating even more strongly that the estimates were not produced just by chance. The Log likelihood for normal in the Tobit estimation was -.465.

The results of the multiple regression analysis, in sum, showed substantial evidence for the proposed relationships among the variables. Three of the hypotheses were supported, one was partially supported, and three were not supported. Significantly, more than 92 percent of the variation in Internet use was explained using the complete multivariate model and about 90 percent was explained by the reduced final model. The next chapter presents a discussion of the regression results in view of the literature review. Suggestions for future research are offered in the final chapter.

## CHAPTER 6

### DISCUSSION

Internet growth around the globe has been phenomenal. It has been argued that the speed of Internet adoption has been unprecedented in the history of communication technology. According to Nua's September 2002 data, the current worldwide Internet population is 605.60 million (Nua, 2002). Projections for 2004 estimate an increase to 709.1 million Internet users around the world (Cyberatlas, 2002). The Internet offers potential benefits to nations worldwide in the areas of the political development, economic progress, technological advancement, health and education. The World Development Report titled Knowledge for Development noted that today even the "remotest village has the possibility of tapping a global store of knowledge beyond the dreams of anyone living a century ago, and more quickly and cheaply than anyone imagined possible only a few decades ago" (World Bank, 1999, iii).

The Internet has changed world communications and the development of nations, yet research on what affects its growth internationally remains inconsistent and inconclusive. The main goal of this study was to identify the most significant predictors of Internet adoption in the post-communist countries. A brief summary of the results is presented below, followed by a discussion of the descriptive statistics and the hypothesis testing.

#### Overview

This dissertation proposed and tested a five-dimensional theoretical framework to explain the variations in Internet use across the post-communist countries. Three factors

emerged as critically important: economic, political, and technology/infrastructure factors. Cultural factors seemed to exert some impact, but the results were inconclusive. These findings suggest that the traditional country-level indicators of economic wealth and technological infrastructure are just as important, and maybe more so, in today's digital age. They serve as strong determinants of Internet use in the countries of Eastern Europe and the former Soviet Union. But democratization level emerges as even more important than income and infrastructure in that region. More democratic societies, which offer greater freedoms to their citizens, are likely to encourage more extensive use of the global network of networks.

The post-communist countries vary widely in Internet use. Looking closely at these 28 countries, there is a noticeable gap, which can be considered a regional digital divide. But what exactly leads to such higher Internet use in one post-communist country and such lower Internet use in another? Some have argued that the answer is national wealth. If this were simply a question of income, though, then Slovenia should be the Internet leader in the region. However, this is not the case. If it were just an infrastructure issue, on the other hand, we should have observed phone-deprived Albania as the Internet laggard in the region. Yet this is not the case either. The process of Internet adoption is a complicated phenomenon influenced by a multitude of factors. The results of this study shed some light on the macro-level indicators that drive Internet growth in the post-communist countries in particular. The findings may be applicable to other regions and other countries around the globe. Yet it should be underscored once more that this analysis focused only on the 28 nations of Eastern Europe, the former Soviet Union, and

Mongolia. Therefore, applying the five-dimensional theoretical framework proposed here should be made within the regional context.

The results of this study clearly identified four specific factors as critical determinants of country-level Internet adoption: democratization, teledensity, national income, and Muslim religion. All of these factors except Muslim religion have a positive impact on Internet diffusion levels. Being a predominantly Muslim country, however, seems to exert a negative impact on Internet diffusion. This can be an indication of strong cultural differences associated with countries where Islam is the dominant religion. Another possible explanation for the negative relationship could be that, incidentally, the Muslim countries in the region have been historically in the "backyard" of the former Soviet bloc. The Central Asia republics of the former Soviet Union in particular have had less developed infrastructure and lower political autonomy in the past. Thus, the negative relationship between Muslim religion and Internet use could be only a reflection of long-lasting historic legacies.

The rest of this chapter goes deeper into interpreting the presence and absence of relationships when testing the five-dimensional theoretical framework. First, we briefly look at the descriptives and the meaning of Hypothesis 1. Next, we turn to each of the six initial predictors and attempt to explain their influence on Internet use in the post-communist countries.

### **Discussion of Descriptive Analysis**

#### **Regional Variations**

This section briefly reviews the range of variations among the post-communist countries across the six variables of interest: national income, democratization, telecommunications policy, teledensity, education, and religion.

The majority of the 28 post-communist countries are lower middle income, a few are low income, and only six are classified by the World Bank as upper middle income. Only one country--Slovenia--is a high income country according to the World Bank classification. Most of the countries in the region, however, remain in the lower middle income group.

Naturally, the countries in the region differ widely in their level of democratization. None of the post-communist countries is ranked as completely free or democratic, compared with the rest of the world. Nine countries are ranked as mostly free and can be considered aspiring democracies. Only one country is absolutely undemocratic--Turkmenistan. As expected, that country has lower Internet use than most; it ranks #26 among the 28 countries. The rest of the post-communist countries are in the middle range of the civil liberties ranking, with some having made more progress than others. Belarus is an example of a country where political and civil freedoms have been restricted by the government. It ranks #23 among the group.

Telecommunications privatization in the region as a whole has been slow. Privatization of the major telecommunications operator was successful in 2 out of 5 cases only. Several countries including Estonia and Hungary have successfully privatized their PTTs. The majority of countries, however, are lagging behind in the telecommunications privatization process.

Telephone penetration in the post-communist countries is relatively high compared with Africa, for instance, but lower than Western European levels. The teledensity across the region also varies widely: the country with highest teledensity --Estonia--leads the country with lowest teledensity--Albania--by a factor of 16. Mobile phone penetration

has increased throughout the region, but remains much lower than landline telephone use. Yet traditional residential phones remain outdated in terms of connection quality.

The post-communist countries have been well known for their advanced educational system. Traditionally, college attendance in the region has been high. Not surprisingly, there is relatively little variation in terms of tertiary education ratio in the region. Compared to other regions, the post-communist countries rank higher in relative terms. Their mean tertiary education ratio is approximately 28 compared to tertiary percentage enrollment of 1 in Angola and Haiti, 11 in Iraq, 15 in Brazil, and 16 in Mexico. The education level of Western European nations, however, is somewhat higher: 62 for Norway, 51 for France, and 45 for Denmark.

The most common religion in the region is Eastern Orthodox religion. The other two major groups are Western Christians and Muslims. Western Christianity includes Protestants and Catholics. It is interesting to note that most of the former Soviet republics located in Central Asia are Muslim countries. Compared to other regions, the post-communist countries are more uniform in terms of religious composition. A clear dominant religion exists and the population is highly homogeneous for the countries in this group unlike the United States, for example, where different ethnic minorities and various religious affiliations are abundant.

### **Growth of Internet Use**

The Internet is one of the fastest growing communication technologies (WIPO, 2001). It has been adopted globally at an unprecedented pace. Yet, as earlier chapters of this dissertation noted, many world regions are still behind in Internet use compared with the United States and Western Europe (Daly, 1999; Dasgupta et al., 2001; World Bank, 1999, 2000). Even though Jupiter Research projects that by 2005, the U.S. share of the

Internet population will drop to 24 percent (Jupiter Research, 2001a), there is still an imbalance between Internet-rich and Internet-poor countries. Indeed, there are huge inequalities in Internet access and use around the world (Norris, 2000).

Some striking figures help illustrate the magnitude of this digital divide. For example, Dasgupta et al. (2001) show that in 2000, 90 percent of the world's Internet subscribers came from countries with 15 percent of the world population (Dasgupta, et al. 2001). Developing countries account for only 26 percent of all Internet users, with only 2 percent of the population in these countries being online (ITU, 2001). These numbers illustrate the severe inequality in terms of Internet access across countries worldwide.

Sub-Saharan Africa is one region where the adoption of Information and Communication Technologies (ICTs) has been much slower. Eastern Europe is in the middle of the road, faster in adoption of the Internet than African countries, but slower than Western European countries. The post-communist countries seem to parallel Internet adoption and penetration in Central and Latin American countries.

Still, the number of Internet users in the post-communist countries remains slim compared to that in the United States. Howard et al. (2001) report that the Internet has become a vital part of the lives of Americans. Data show that 87 percent of the American population uses email and 33 percent uses the Internet to retrieve information regularly. In addition, the study reports that 21 percent of Americans use the Internet for major life activities such as doing research online about health care and jobs and 9 percent also make transactions online (Howard et al., 2001).

One important finding of a 2000 survey is that the younger Internet users are "more likely to . . . gather most kinds of information, and to perform financial transactions

online" (Howard et al., 2001, 390). They also conclude that there are "a variety of demographic factors that affect people's use of the Internet, including gender, age, education, income, race and ethnicity. But the most useful predictors of the activities that users enjoy online are their length of experience with the Internet and their frequency of logging on from home" (Howard et al., 2001, 403). Clearly, the length and frequency of Internet use are important predictors of online activities (Howard et al., 2001). Demographic variables also continue to be important predictors of Internet use.

The size of the American online population has increased tremendously over a short period of time. Katz et al. (2001) show that the number of users in the U.S. increased from 8 percent in 1995 to 65 percent of the population in 2000 (Katz et al., 2001). In terms of composition, they observe that the number of users age 40 and older increased over time. Among a group of demographic predictors, income and education emerge as the most salient factors affecting people's awareness of the Internet (Katz et al., 2001). They conclude that the digital divide within the USA is shrinking.

Hypothesis 1 of this dissertation addressed the question whether the average number of Internet users in the post-communist countries increased significantly from 1995 to 1999. The statistical comparison clearly indicated that, indeed, there had been a significant increase throughout the region.

The number of Internet users in the post-communist countries did increase significantly during the five-year period from 1995 to 1999. Even though this hypothesis only tested the trend for 19 countries (no data for the other nine were available for 1995), it is fair to predict that the growth in the rest of these countries will follow a similar trend. In fact, looking at the descriptive statistics for Internet users in the region, we expect that

the countries lagging further behind will exhibit faster adoption and increase use at a higher speed. This, of course, can be extrapolated not only from the descriptives, but from the diffusion S-curve, which postulates that after a steep increase in the adoption of any technology, the diffusion speed decreases and adoption levels off.

Compared to the rest of the world, the post-communist countries fall in the middle range in terms of Internet adoption. On average, about seven percent of the population in the post-communist countries is online. Internet indicators reveal an unexpectedly strong disparity in usage across the countries. The Economist found that Hungary, for instance, is ranked much higher than Ukraine in e-readiness (*The Internet's new borders*, 2001). The Czech Republic and Slovenia are also more advanced than Albania and Azerbaijan in terms of Internet access, use, online commerce and other online activities. In 1999, Estonia, for example, had 175 Internet hosts per 10,000 people while Albania had only 0.24. Data on Internet penetration in Hungary show that 7.1 percent of the population was online in October 2000 (Minges, 2001). On average, about seven percent of the population in the post-communist countries was online as of 2000. This number is growing rapidly (CDT, 2000; *The Internet's new borders*, 2001; ITU, 1999).

There seems to be a digital divide in the region, with Estonia and the Central European countries at the top and the Central Asia former Soviet republics at the bottom. The three countries that are leaders in Internet adoption are Estonia, the Slovak Republic, and Slovenia. The lowest eight countries are Albania, Azerbaijan, Belarus, Bosnia and Herzegovina, Mongolia, Turkmenistan, Tajikistan, and Uzbekistan. There is clearly a wide disparity in Internet use across the post-communist countries. The difference in

Internet users per 10,000 people between the top and the bottom was more than 400 times in 1999.

The Internet has become important in some of the countries, where specific uses and projects have emerged. The Internet made possible, for instance, the development of medical centers within the region. One project links a major hospital in Ukraine with doctors in Finland for real-time medical support.

### **Discussion of Hypotheses 2 through 6**

This section provides an interpretation of the results of the multiple regression analysis used to test Hypothesis 2 through Hypothesis 6.

#### **National Income**

The most commonly used predictor of per capita Internet use is probably national income, measured as Purchasing Power Parity Gross National Product per capita (PPP GNPP) in this study. The second hypothesis stated that higher per capita income would contribute to a higher number of Internet users per capita. The regression results strongly supported this hypothesis.

The positive impact of national income on Internet use may come as no surprise to some scholars. Previous studies on Internet diffusion across countries have shown the importance of economic development for ICT growth. Thus, the results of this study are in agreement with Arnum and Conti (1998), Bazar and Boalch (1997), Elie (1998), and Hargittai (1999).

A few previous studies, however, have shown no significance of macro-level economic factors. Income per capita was insignificant in a study conducted by the World Bank, for example (Dasgupta et al., 2001). The results of this research refute such studies and suggest that Internet disparities across the post-communist countries are more than

just a reflection of infrastructure inequalities, as some studies suggest. The digital divide in the region is due, at least in part, to the economic inequalities between the countries. Future studies of cross-country Internet diffusion should incorporate national income as an important determinant, but take into consideration that it is not the only determinant that plays a role in the process.

It was expected that GNP per capita might turn out to be the variable with strongest explanatory power in the final multiple regression model. Some studies have shown that national income level is the strongest predictor of Internet adoption (Beilock & Dimitrova, 2003; Elie, 1998; Hargittai, 1999). This was not the case in our findings. One reason for the relatively lower significance of national income among the predictor variables may be partly due to the multicollinearity between GNP and teledensity. The implication of such multicollinearity is that these two variables, if entered together in the model, may lower each other's significance.

In this study, national income was the third most significant determinant of Internet diffusion, following democratization and teledensity. As Internet connection prices go down relative to average wage, the income factor may be further reduced in its importance in the post-communist world. This is supported by a comparison of Western European nations where income did not appear significant as a predictor of Internet usage rates (Beilock & Dimitrova, 2003). It may be expected that the importance of income would wane over time. It should be noted, however, that national income level will remain an issue in countries where the hourly rate for Internet connection equals or exceeds one percent of the monthly salary.

## Democratization

Level of democratization was used as a political factor in the five-dimensional analytical framework. Compared with income and infrastructure factors, democratization is not incorporated as frequently in diffusion studies. It was considered an important factor in this analytical framework, however. This study predicted a positive relationship between the level of civil liberties and Internet adoption levels. The results of the multiple regression showed that the higher the level of civil liberties in the country, the higher the number of Internet users per capita.

This finding supports the argument that political factors are critical for Internet development. Civil liberties are an indicator of the level of democratization. The process of democratization has been particularly important in the region. In fact, the word "democratization" is often used synonymously with the word "transition" in the post-communist world. Democratization as a broad term also refers to the opening of society to the rest of the world and not just to the political and civil freedoms allowed in the country.

Norris (2000, 2001) observed a recurring trend that established democracies around the globe tended to have higher Internet penetration. Bivariate correlations clearly showed that higher level of democratization and higher Internet use were positively related (Norris, 2001). Yet, Norris (2001) found no statistical significance of the democratization variable in her world model. In this study, however, democratization emerged as the most influential factor in the region of the post-communist countries. This could be partially due to the specificity of the region examined in this study.

Civil liberties appear to be critical for Internet adoption in the post-communist countries. The civil liberties composite variable used here includes several areas. One is

the freedom of expression and belief. The existence of free and independent media then is positively related to Internet growth. Another aspect of civil liberties is the freedom of assembly and demonstration, in other words, freedom to protest openly. It may not be far-fetched to argue that countries which do not allow freedom of assembly are likely to restrict Internet use as well. In addition, an independent judicial system, respect for human rights, personal autonomy and economic rights are also important civil liberties. We infer that countries that restrict such rights are likely to have lower Internet penetration.

These conclusions are supported by Rodriguez and Wilson's (2000) study, in which they underscore the significance of political freedoms and civil liberties for the technological progress of developing countries. They argue that the existence of a climate of democratic freedoms not only facilitates, but also is a requirement for the faster adoption of ICTs (Rodriguez & Wilson, 2000). The existence of civil liberties as a necessary condition for Internet adoption has been overlooked in the literature so far.

It is important to note that there may be exceptions to the rule. Some countries with undemocratic governments have very high Internet use. Singapore and China are two examples of that. While these countries were not examined in this study, it is plausible that in both cases high Internet use may be related to systematic government policies to encourage use. In the case of Singapore, it is important to note that the country has the lowest Uncertainty Avoidance Index (UAI) score in the world (Hofstede, 2001). Therefore, some cultural factors may dominate over the level of democratization in society in certain cases.

### **Telecommunications Privatization**

Many scholars have underscored the significance of government policies when discussing Internet adoption. Petrazzini and Guerrero (2000), for example, note the importance of telecommunications policy in the Latin American countries. Tanner (1999) discusses the significance of telecommunications policy in regard to Western Europe. Sallai (2000) and Wolcott et al. (2001) also have noted the importance of policies in the telecommunications sector for the growth of Internet use.

The five-dimensional analytical model proposed that a longer period of telecommunications privatization would lead to a higher number of Internet users across countries. Privatization was not a significant predictor in this study, however. This finding is in accordance with the Kiiski and Pohjola (2001) study, which finds no effect of telecommunications policy on country-level Internet use. However, we need to be cautious in interpreting that telecommunications privatization has an effect on national Internet development.

One possible explanation for the lack of significance of the telecom privatization variable may be simply the distribution of the data points. In other words, the lack of importance may be largely due to the fact that many of the values of the policy variable equal zero as of the end of 1999. If that is indeed the case, it is likely that the effects of telecom privatization will be visible in the long run, and that telecommunications policy will show increased importance over time.

Previous research again in the Western European countries found a strong explanatory power in policies regarding the telecommunications sector. Hargittai's (1999) research on Internet connectivity among the Organisation for Economic Cooperation and Development (OECD) countries is one of the important studies that

show a significant relationship between Internet use and telecom policy. She showed that countries that have allowed free competition, or even some degree of competition, have higher Internet penetration than countries with telecom monopolies (Hargittai, 1999). Even though the results of this study do not support Hargittai's findings, it is, again, likely to see stronger effects of telecommunications policy on Internet use in the near future.

The apparent contradiction between Hargittai's conclusion and the findings of this research may be explained by the fact that each study measured telecommunications policy in a different way. Hargittai (1999) used the level of competition (monopoly, duopoly, competitive market) in the telecommunications sector as a predictor. That predictor reflects one aspect of telecom policy--demonopolization. This study, however, modeled telecom policy by a privatization variable. It appears that length of privatization may be insignificant for Internet adoption in contrast to level of competition in the telecom market. We need to distinguish between these two different aspects of telecommunications reform, but also bear in mind that different policy dimensions may influence Internet use differently in different regions. Hargittai's (1999) study focused on OECD countries (Western European nations) while this study examined Eastern European countries and former Soviet republics.

Still, telecom market privatization may play an important role in the post-communist world's technological future. A number of previous studies have suggested that it is critical to include the level of privatization when studying Internet adoption in the post-communist countries (Ellis, 1999; Fish, 1998; Gulyas, 1998; Kuentzel et al., 2000; Maddock, 1997; Papir & Oleszak, 2000; UNDP, 1999). Even though the effects of

privatization in general and the main telecommunications operator in particular may be yet invisible, their long-term impact in the transition countries needs to be followed. Future studies should also consider other measures of telecommunications policy such as level of competition in the telecommunications market in addition to length of privatization.

### **Infrastructure**

Technological infrastructure has often been described as one of the barriers to increased Internet diffusion. When there are more telephones in New York City than in several African countries combined, the existence of strong cross-country Internet discrepancies is hardly a surprise. This study tested the relationship between teledensity and Internet use per capita. Even though the relationship between the two variables was positive, it was not significant at first in the complete regression model. However, subsequent analysis showed that telephone infrastructure emerged as the second most important factor in the Internet diffusion process.

The teledensity variable, even though insignificant in the complete model, remained in the final model after backward regression was conducted. There are at least two possible reasons for this phenomenon. The most likely reason may be that there is some indirect relationship between teledensity and telecommunications privatization, both of which are in the full regression model. Conceivably, countries which privatized their telecom operator earlier have higher teledensity to begin with, which makes the effect of both variables disappear. Therefore, teledensity becomes significant once the less influential privatization variable is removed from the regression model.

Another possible explanation could be the high multicollinearity between GNP and teledensity discussed earlier in this study. In cases of such high correlation between

explanatory variables, it is common to see that one variable increases its significance at the expense of the other one and vice versa. Additionally, even though teledensity is not statistically significant in the complete model, it still contributes to its overall explanatory power.

Since existing infrastructure significantly affects Internet adoption at the country level (Arnum & Conti, 1998; Bazar & Boalch, 1997; Elie, 1998; Gulyas, 1998; Hargittai, 1999; Lin, 1998; Sadowsky, 1993), variations in Internet use are to be expected between countries with different levels of infrastructure development. This study looked specifically at telephone infrastructure. The relative degree of difference between countries in the post-communist world, however, may be much smaller than the differences that exist between Rwanda and France or Morocco and Finland, for example. Telecommunication infrastructure varies widely across continents, regions, and countries (Daly, 1999; ITU, 2000). The variations are not as stark within the former Soviet bloc region, however. Therefore, we expect that the importance of pre-existing telephone networks may be higher when comparing all countries in the world. Beilock and Dimitrova (2003), among others, have shown that teledensity is a significant determinant of adoption, examining a world model of 105 countries. Telephone infrastructure then appears to be critical for Internet adoption on a global scale.

It is important to note that this dissertation is one of the first studies to include mobile phones and not just residential phones as part of the technology infrastructure. This is an innovative approach, which may be useful in future research because the importance of mobile telephone infrastructure is expected to grow over time. The only drawback of this approach is that the individual effects on residential versus mobile

phones cannot be isolated. Thus, we can only conclude that both residential and mobile phones are significant in the Internet adoption process.

### **Education**

Previous research, for the most part, has shown that educational level is an important determinant of Internet use. The results of this regression analysis, however, did not support this proposition. In fact, higher education seemed to be related to lower Internet use in the region of interest. Even though the results for the education predictor were not statistically significant, we need to address not only the lack of significance, but also the negative sign of the correlation coefficient between college education and Internet use.

It is important to note that the post-communist countries offer good quality education--both at the high school and college level. Even though the 1999 Human Development Report underscores that education in the region as a whole has recently deteriorated, both in terms of quantity and quality (UNDP, 1999), the basic educational level of the general population remains high. Typically, more educated people tend to be earlier adopters of technology (Rogers, 1995). Yet we found a negative relationship between educational level and Internet use.

Does education matter? The results of this study are inconclusive. The tertiary enrollment ratio used here as a measure of educational achievement was not statistically significant. Even more surprisingly, the regression coefficient for that factor was negative. This seems contradictory to previous studies that found a positive relationship between education and Internet use. There are at least two possible explanations for this inconsistency.

First, it seems that younger people tend to be heavier Internet users (Howard et al., 2001). This is particularly true in the post-communist countries (Kouznetsov & Bourtsev, 1996). Rose (2002) notes that in Russia, for instance, more than one-sixth of the people under age 29 are Internet users. In other words, age is inversely related to use. Older people in general are slower in the adoption of new technologies, such as the Internet. Yet, older people tend to be more educated. Being older and more mature means being more educated than the younger population, but also, arguably, less likely to use the Internet. Therefore, including education without controlling for age may produce misleading results.

Additionally, basic use of the Internet may be simple enough for people with less than a college degree. How much knowledge does one need to use the Web? The World Wide Web combines text and graphics, and learning the main navigation tools today may require little instruction. Email, which is the most popular use of the Internet around the world, tends to be user-friendly and easy to use. A better education variable to be used could be a specific measure of ICT skills. Finally, UAI tends to be lower among younger people. Future research should try to incorporate UAI into the education variable in order to avoid possible interaction.

One of the few studies that supports the results of the current research was conducted by Kiiski and Pohjola (2001). These researchers also found no statistical significance of the education variable in their analysis of cross-country Internet penetration. It is suggested here that educational level is not an important determinant of Internet use during the early adoption stage. However, it may become more significant at later stages of the Internet adoption process.

## Religion

The study also hypothesized that differences in dominant national religion would affect the number of Internet users per capita. The results of the regression analysis showed partial support for this hypothesis. It seemed that Muslim religion had a significant effect on Internet use in the post-communist countries, but Western Christianity did not.

Religion was incorporated in this study as a cultural measure. The dominant religion in the country was measured as Eastern Orthodox Christianity (the most common religion in the group), Western Christianity (Catholic or Protestant), and Islam. It was argued that these three religions were substantially different from one another (Fish, 1998), and that religion was a reflection of substantial cultural differences across the countries (Hofstede, 2001).

Based on the two dummy variables employed in the study, some interesting findings emerged. First, Western Christianity did not seem to have a statistically significant effect on the level of Internet adoption in the country. Its regression coefficient, however, was positive. In contrast, the coefficient for Muslim religion was negative and statistically significant. This clearly indicated a negative correlation between Internet use and Muslim religion. The causal relationship between the two variables, however, is not so clear.

The following countries from the population of interest are predominantly Muslim: Albania, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Incidentally, the Muslim countries in the sample share some historic legacies. Six of them are former Soviet republics, five of which are located in Central Asia, and one--Azerbaijan--in the Caucasus. Arguably, these countries

received less technological support and less infrastructure investment while members of the Soviet Union. In fact, the telephone infrastructure in some of the Central Asia republics is still quite poor compared with 21<sup>st</sup> century standards. Therefore, it is conceivable that Muslim religion was significant in this study because it captured historic inequalities in the realm of technology and national infrastructure.

To explore the question whether religion serves as a substitute for infrastructure in the multiple regression, a model without the teledensity variable was tested. We performed this regression with the expectation that Western religion would remain significant when the teledensity variable was not included if the first explanation suggested above was true. However, this was not the case. Muslim religion was significant and negatively related to Internet use whereas Western religion was removed from the model even when teledensity was excluded. It may be conceivable that Western religion is positively related to democratization and educational level in addition to teledensity. But it seems more likely that perhaps religion parallels broader cultural differences among the countries of interest.

There is another possible explanation for the negative relationship between predominantly Muslim societies and per capita Internet use. It is possible that religion is correlated with some other cultural factor that is negatively related to Internet adoption. Thus, religion may have a spurious relationship with Internet use and is most likely an indication of some strong cultural differences between Muslim and Christian societies. One such cultural factor could be, for instance, overall openness of society to new

technologies. This is similar to Hofstede's dimension of uncertainty avoidance (Hofstede, 1980, 2001).<sup>1</sup>

Hofstede developed four dimensions of culture: power distance, uncertainty avoidance, individualism and collectivism, and masculinity and femininity. The dimension which relates to the adoption of innovations in general and the Internet in particular is the uncertainty avoidance index (UAI) (Hofstede, 2001). Hofstede (2001, 161) defined uncertainty avoidance as "the extent to which the members of a culture feel threatened by uncertain or unknown situations." Research shows that UAI is negatively correlated with the adoption of new media and use of the Internet (Hofstede, 2001).

Dominant religion seems to reinforce the values that led to its adoption in a particular country. Also it is important to note that religion is listed as one of the three major ways in which society copes with uncertainty. High uncertainty avoidance countries resist innovations and are more resistant to changes in general. In contrast, "low UAI countries tend to have more open-minded mentality, in searching for information and in accessibility to innovation" (Hofstede, 2001, 170). Religion may not cause uncertainty avoidance per se—but both may have a common cause. Hofstede notes that "an established religion reinforces the values that led to its adoption, however, confirming either strong or weak uncertainty avoidance" (2001, 177).

For instance, two Muslim societies—Turkey and Pakistan—are ranked very high in UAI. This suggests these societies as a whole will be less receptive to new technologies. At the other end of the spectrum are Singapore (with the lowest UAI score), Denmark

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<sup>1</sup> However, no data exist on the ranking of the post-communist countries according to Hofstede's cultural dimensions, with the exception of former Yugoslavia. Hofstede also notes that the uncertainty avoidance ranking of Yugoslavia is not highly reliable. Today Hofstede's questions are included in the European Media and Marketing Survey that is administered in the member countries of the European Union.

and Sweden. These countries have lower uncertainty avoidance, and anecdotal data show that they are among the leaders in Internet use in the world.

In either case, this study partially supports the idea that culture plays a major role in adopting technological innovations. However, culture is a very complex concept, as many authors have noted (DiMaggio, 1997; Hofstede, 1980, 2001; Sondergaard, 1994; Tayeb, 1994).

Therefore, it is difficult to capture all dimensions of culture. Our observations and data analysis showed that, controlling for income and infrastructure as well as for other factors, Muslim religion was negatively related to Internet use whereas Western Christianity had no effect. It would be necessary to test the effects of religion on a worldwide model before making conclusive remarks in this regard. In addition, it would be desirable to include other cultural variables in future studies of Internet diffusion, when data permit.

### **Refined Conceptual Framework**

This study proposed a five-dimensional theoretical framework for explaining cross-country adoption of the Internet. The overall conceptual model included economic, political climate and policy, infrastructure, audience, and cultural factors as determinants of adoption. The study showed that three of these factors--namely economic, political, and infrastructural--play an important role in the Internet diffusion process in the post-communist countries. There was partial support for the influence of cultural factors, as revealed by the effect of religion. The policy variable used here--telecommunications privatization--did not appear significant. Finally, the importance of audience characteristics measured by education in particular was not supported.

The four specific variables that remained highly significant in this study were per capita income, democratization, teledensity, and Muslim religion. These four predictors explained a large amount of variation in Internet use in the post-communist countries. As expected, higher income, democratization, and teledensity led to higher Internet adoption levels. These highly significant predictors of Internet adoption are likely to remain important in the future. Being a predominantly Muslim country seemed to affect Internet use negatively whereas being a predominantly Protestant or Catholic country had no effect. This partial support for the influence of religion points to the potential impact of certain cultural predispositions. However, better measures of cultural differences need to be developed in order to gather more evidence of their influence on Internet adoption.

Surprisingly, the telecommunications policy variable was not significant in this study. However, this finding may have been driven by the specifics of the data and the brief period of time over privatization was examined. It is expected that the privatization policies would show an effect in a time-series analysis over an extended period.

It is also conceivable that a different policy measure--for instance, telecom market competition--may be a better determinant of Internet adoption. This study measured only one aspect of telecommunications policy--privatization of the national telecommunications operator. Privatization by itself may not be sufficient to bring about demonopolization in the telecom sector. Both privatization and demonopolization are considered important aspects of telecom liberalization in general.

Finally, we found educational level to be irrelevant for Internet adoption in the post-communist countries. It is conceivable that this is an artifact of the relatively small variation of the education variable across these countries. Another possible reason is that

the early adopters of any technology tend to be highly educated. Therefore, it is likely that the early adopters in each of the post-communist countries are the highly educated elite to begin with, so looking the average number or the whole population may be misleading. If this is indeed the case, the influence of education is likely to be more visible at later stages of Internet adoption when a higher percentage of the population joins the online community.

The most convincing argument for the lack of significance of education seems to be its inverse relationship with age. Younger people tend to have lower education but seem to be the more likely Internet users. It is also important to point out another possibility: overall educational level may be misleading because it is not education per se that we want to capture, but rather the specifically Internet or computer skills of the population.

Some clarification is necessary regarding the role of audience factors in the Internet adoption process. An important audience variable is English language proficiency. Considering that the majority of Internet content today is in English and that many operating systems and software programs (such as Microsoft Windows and Internet Explorer) are available only in English in the countries of interest, this variable is needed as a determinant of adoption, even though data for it were not available at this stage. Thus, future studies should include English language proficiency and test for its effect on national Internet usage levels.

This dissertation examined only the effects of macro-level determinants. Of course, there are other factors that affect diffusion at the individual and institutional level. Norris (2001) conceptualized Internet diffusion to be studied at the following three levels: macro, meso, and micro level. An extension of this research should zoom in on the

countries of interest and determine the effect of meso- and micro-level factors. These, again, may become more relevant at later stages of adoption.

In sum, the results of this study suggest that even though economic factors are important for Internet adoption in the post-communist countries, infrastructure, political and cultural factors do matter as well. The findings of this dissertation have important implications not only for the post-communist counties, but for nations across the globe. These theoretical and practical implications are discussed in the final chapter.

## CHAPTER 7 CONCLUSION

The global digital divide has become a concern for policymakers at both the national and international level. Kofi Annan, the United Nations Secretary-General, warned about the possibility that the poor of the world could be excluded from the information revolution: "These people are deprived of many things: work, shelter, health care, and drinking water. But to be isolated from the major telecommunication services now is an equally grave deprivation, and chances to remedy this situation are shrinking" (Annan, 1999). The growing digital divide is even more disconcerting because the gap between the developing and the developed world in information and communication technology adoption is greater than the traditional gaps of income and welfare (Daly, 1999; Rodriguez & Wilson, 2000). As explained below, the results of this study can be used by the lesser connected countries to improve their Internet connectivity and thus help bridge the gap between the Internet-rich and Internet-poor world.

### **Conclusions**

This study developed a five-dimensional theoretical framework to explain the variations of Internet use in the post-communist countries. Based on the findings of the study, we conclude that economic, political, and technology/infrastructure factors positively affect Internet use in the region. Cultural factors also seem to have an impact, with Muslim religion adversely affecting Internet use. This negative relationship, however, may be, coincidentally, a reflection of historic inequalities between the post-communist countries.

Using multiple regression to test the five-dimensional framework proposed in Chapter 3, it was determined that democratization, telephone infrastructure, and national wealth were the three most important factors that affect Internet use in the post-communist countries. Other determinants suggested in the literature did not appear to influence Internet use in the region. Having predominantly Western Christian religion seemed unrelated to Internet adoption. National policy--and length of telecommunications privatization in particular--did not appear significant in the analysis either. Additionally, college education was not found to be related to Internet use in the post-communist countries. Contrary to expectations, higher level of education did not predict higher Internet use in these countries.

Three of the five factors proposed in the Internet diffusion framework were found to be important. On theoretical grounds, we can derive a refined conceptual framework based on the empirical results of the study. The new framework includes (1) economic; (2) political; and (3) infrastructure factors. Cultural factors may be important as well, as evidenced by the significance of Muslim religion. Including religion or some other cultural measure is recommended as a fourth component. A measure similar to Hofstede's uncertainty avoidance may be more revealing in capturing cultural differences across nations than religion. Finally, it was observed that national income and telephone infrastructure are highly correlated, so looking at the effects of one and disregarding the other would be a mistake.

The variables which were not significant in this study were telecommunications privatization and educational level. It is recommended to find better proxies for the effects of telecommunications policy and education, respectively. We conclude that the

former should also be measured by telecommunications demonopolization or level of competition in the telecom sector and the latter should capture not education per se but specifically Internet training and ICT skills.

Finally, it is expected that the effects of income and infrastructure will wane over time. On the other hand, the weight of cultural factors is likely to increase at the later stages of the Internet diffusion process, as suggested by Beilock and Dimitrova (2003).

### **Implications**

This research has important theoretical and practical implications. The findings of this dissertation can be of value to at least three major constituencies: policymakers, business companies, and the academic community.

#### **Theoretical Implications**

The findings of this dissertation contribute to the academic research by (1) offering a descriptive analysis of Internet use; (2) showing which factors affect Internet adoption in the post-communist world; (3) developing a comprehensive model of Internet diffusion that can be applied to other countries and regions of the world; and (4) extending diffusion of innovations theory to the country level and showing which of its generalizations apply to Internet adoption in the post-communist countries.

This dissertation fills a gap in the literature because it offers an extensive description of Internet adoption in the post-communist countries. No previous studies have examined Internet variations in the region in such detail. This study is one of the first to show clearly the existence of a digital divide not only around the world, but also among the post-communist countries.

Further, the dissertation identifies a specific set of factors that affect Internet adoption in the post-communist world. Thus, it contributes to the body of literature on

cross-country Internet diffusion by shedding light on the determinants of the diffusion process in a specific region of the world. The results clearly show that economic, political, and infrastructure factors measured by per capita income, level of democratization, and teledensity respectively, influence Internet use in the region. There has been a void in the literature on Internet adoption in countries other than the industrialized countries of the world, and our findings fill this void.

Probably the main theoretical contribution of the dissertation is that it develops a more comprehensive model of cross-country Internet diffusion than any previously tested models. The proposed five-dimensional model is broader and more accurate than earlier bivariate models. In addition to the economic and infrastructure variables tested in previous studies, it adds the variables of culture and democratization. This comprehensive model of Internet diffusion also incorporates audience characteristics and policy variables, which have been suggested in previous studies, but rarely included in a multivariate analysis. Another advantage of this five-dimensional framework is that it can be easily applied to other countries and regions of the world and not only to the post-communist countries.

Finally, the dissertation used some of the generalizations of the diffusion of innovations theory and applied those to the country level of adoption. Our results showed that income and education as well as culture can be translated and used not only at the individual but also at the societal level of adoption. However, a more appropriate measure of education than college education may need to be developed when studying Internet diffusion.

### **Applied Implications**

Policymakers at the local, national, and international levels can use this study to develop or modify policies aiming at accelerating Internet use in the former Soviet bloc countries. The results of the study can be used as guidelines for Internet diffusion in other countries as well. Governments, non-governmental organizations (NGOs), and international organizations can benefit from the empirical results of this study, assuming that these organizations have a vested interest in promoting Internet development in the so-called transition economies of Eastern and Central Europe and the former Soviet Union.

The findings of this research are particularly relevant to NGOs and international organizations that are trying to understand and promote Internet adoption around the world. As Rodriguez and Wilson (2000) note, multilateral and bilateral support for information and communications technology activities in developing countries is warranted because of the increasing global technological gap. Organizations such as the Open Society Foundation, the International Telecommunication Union, the United Nations, USAID, and the World Bank may benefit from the results of this dissertation and use them as guidelines for their international Internet-related projects.

The study examined Internet adoption in the post-communist countries. The results identified three main factors--democratization, infrastructure, and national wealth--that facilitate Internet diffusion at the country level and suggested other factors that serve as barriers. The results demonstrated not only the direction, but also the strength of relationships between these factors.

The level of democratization emerged as the most important determinant of Internet adoption relative to the other predictors in the framework. This finding may be deemed

relevant to policymakers because it shows that limiting democratic freedoms affects Internet adoption negatively. On the other hand, encouraging free expression, independent media, and freedom of assembly can lead to increased Internet penetration.

The findings of this dissertation also confirmed the importance of teledensity in the process of Internet adoption at the global level. Teledensity emerged as the second most important determinant after level of democratization. Organizations such as the World Bank that deal with inequality around the world may base their future projects on the knowledge that infrastructure gaps still serve as major barriers to Internet adoption, even in the post-communist countries.

Consistent with previous research, national income was found to be significant for country-level Internet adoption. It was the third most important predictor in this study. One way to increase adoption then would be to increase the wealth of the country. This finding has ramifications for national governments and loan granting agencies at the national and international level.

The practical nature of this study also makes it useful to the business community. Companies in Internet-related businesses that plan expansion to the post-communist countries can find the descriptive results of the study useful. The study could help them make strategic decisions on which country to enter first (e.g., Estonia would be a good choice since it is the leader in Internet adoption in the region). In addition, this dissertation can be helpful to local Internet companies and Internet service providers (ISPs). The ISPs can adjust their pricing structures accordingly based on the finding that economic factors serve as a barrier to Internet diffusion. Finally, the study has potential utility to market research companies that measure and forecast Internet levels at the

international arena. Such companies can compare the speed of adoption in this region to other regions in the world and possibly make some predictions when the Internet is likely to reach universal penetration in the post-communist countries.

The potential benefits of Internet adoption and use were discussed at length earlier in the manuscript. Probably the most amazing contribution that the Internet brings to people and organizations worldwide is the quick, cheap, and seamless transfer of knowledge. "Knowledge is critical for development, because everything we do depends on knowledge" (World Bank, 1999, 16). The Internet provides a venue for any individual to learn about a multitude of topics--from successful business competition strategies to how to treat infant illnesses. Therefore, increased Internet access is likely to bring more independence and knowledge to people of all walks of life.

Some studies have shown concern that the benefits of the Internet would be reaped only by the highly developed nations and that less developed countries would gain less from increased Internet use. Roller and Waverman (2001), for example, argue that increases in telecommunications infrastructure lead to higher growth among more economically developed countries, such as the OECD countries. The growth effects are expected to be lower in less developed countries (Roller & Waverman, 2001). Daly (1999) notes that, paradoxically, "those who have to get most Internet benefits, and those who have the greatest needs have least access to the new technology." Further studies should examine whether wealthier countries gain more benefits from new technology adoption than less developed countries.

Even if this difference turns out to be true, there is still a bigger danger of leaving the developing countries completely behind in the information revolution (Rodriguez &

Wilson, 2000). That can lead to further increase knowledge gaps (World Bank, 1999). On the other hand, if developing nations institute policies and establish institutions to help Internet adoption, then can catch up with the industrialized world (World Bank, 1999).

A report by the European Commission (2001) on the digital divide notes that the benefits from increased ICT use may be more qualitative and are not as tangible. Therefore, it is difficult to find hard numbers to support the argument of how beneficial the Internet is. Some of the areas in which the Internet had been considered a positive force are economic development, the political process, leapfrogging, and social life.

The Internet affects the economic situation in a country as it facilitates international trade, lowers production and distribution costs, optimizes productivity within and between companies. In terms of contributions to political sphere, the Internet allows people to speak publicly and publish information to wider, global audiences. In addition to serving as a regulation-free information source, the Internet provides an avenue for political communication and mobilization.

Leapfrogging is the ability of countries less developed technologically to skip generations of intermediate technology and adopt the latest one--in this case, the Internet. The adoption of the latest technology is considered beneficial to the country. Arguably, it serves to facilitate catch-up with more technologically advanced societies.

The Internet also affects social life. Online applications such as chat rooms and email bring people of all nationalities and ethnic backgrounds closer together. These online applications redefine social relationships within countries. The effect of virtual communities are expected to increase in the future.

Increased Internet use also has certain ideological implications for the national population. The Internet has been seen as a vehicle for transmission of a number of ideologies. It allows more democratic communication to take place. Yet it also allows the Taliban and other extremist groups to establish worldwide networks and to communicate outside national borders.

This discussion leads to the question: Is technology neutral? While it is beyond the scope of this study to answer this question, it is important to differentiate between the different functions of the Internet. There definitely some beneficial aspects: free and open expression online, possibility for political participation, leveling off competition during economic transitions, and finally social connectivity. However, some of the negative spillover that the Internet can bring to nations are values of consumerism, individualism and militarism. Therefore, it is imperative to have a clear distinction between the specific uses of the global network of networks, which makes it difficult to predict the exact implications of increased Internet use.

### **Limitations**

This study has several limitations. Problems with data availability made it necessary to include proxy variables for a number of factors identified in the literature review. In particular, cost of Internet connection and culture had to be measured with proxy variables. English-language proficiency statistics were unavailable at the time of this research. Lack of data is a common problem in the post-communist countries, where no reliable regional comparative data sources exist (Fish, 1998).

In an ideal world, social science researchers will not have to deal with issues of nonexistent or unreliable data. In reality, we choose the best data available to us when

conducting our research. However, it is important to understand the limitations of the data.

### **Validity**

It is critical to assess the validity of the study to assume no systematic bias was introduced into the results. Several forms of validity exist. The two broad types of validity--internal and external validity--are reviewed below.

#### **Internal validity**

Internal validity refers to the question whether all variables, measures, statistical procedures, and inferences were sound and robust. Babbie (1995) discusses four types of internal validity: face, content, criterion, and construct validity. Face validity in a study is gained by careful inspection of the concepts and their measures. Basically, it examines if the measures and the results of the study seem appropriate at face value, which is true in this research. All variables, test procedures, and findings of the study have high face validity.

Content validity establishes that the measure covers the full range of concept's meanings. Content validity is high for all variables used in this study except for culture. As aforementioned, culture is a complex phenomenon, and its meaning involves more than national religion. Lack of data for the uncertainty avoidance index of Hofstede prevented us from using that arguably more appropriate measure of cultural differences between societies. It was beyond the scope of this study to develop and estimate other measures of culture.

Criterion or predictive validity refers to the questions whether scores obtained on one measure can be accurately compared to those obtained with an already validated measure of the same phenomenon. The predictive validity of our measures is high

because they are based on previous research and the results are consistent with earlier studies.

Finally, construct validity applies to situations where there is no clear criterion for validation purposes of a particular variable. In this case, a different measure related to other measures already in theory is the use of teledensity as a combination of both residential and mobile phones. Previous Internet adoption studies have incorporated only residential phones as an infrastructure variable. The increasing significance of mobile phones in the post-communist countries made it necessary to construct this new infrastructure variable.

The internal validity of the study overall is high because all measures were sound and regression assumptions were met. One concern may be the relatively small number of observations/countries used in this exploratory study. As explained earlier, however, the study incorporates the population of interest—all 28 post-communist countries.

The dependent variable used to measure Internet adoption within a country was Internet users per 10,000 as reported by the International Telecommunication Union. It is very difficult to estimate how many people are using the Internet within a country (Castells, 2001; Daly, 1999; Press, 1997; Zook, 2000, 2002). One of the challenges for developing countries in particular is that people often use the Internet from cyber cafés, which is unaccounted for by domain-based measures. Also, current Internet data collection methodologies publish different figures of Internet use, which suggests that they do not provide completely reliable data. The data on number of Internet users per capita, therefore, need to be considered only an approximation of the actual number of Internet users in the country.

Some of the predictor variables point to other issues that need to be addressed. The Gross National Product variable (GNP) by definition reflects only officially reported economic data. However, UNDP (1999) underscores that shadow economies, which remain mostly unreported, are a substantial part of the national economies of the post-communist countries. For example, the shadow economy as percentage of GDP was close to 17 percent in Bulgaria and over 19 percent in Russia in 1996 (UNDP, 1999). The results of this study, however, are based only on officially reported GNP statistics.

Somewhat surprisingly, education was not significant in this study. It appears that the difference between Tajikistan and Slovenia in educational level may be less pronounced than the difference between Tanzania and the Netherlands, for instance. The lack of significance may be also a result of the way education was measured--as tertiary education ratio.

It was unexpectedly difficult to locate English language proficiency data. Data on percentage of high school students studying English exist, but only for the current and future members (candidate countries) of the European Union. Therefore, English language proficiency could not be included as an explanatory variable in this analysis. It is suggested, however, that future studies of cross-country Internet diffusion should incorporate English language as a determinant of Internet adoption.

Multicollinearity--the high correlation between several independent variables--was an inherent problem in this research. Multicollinearity was highest between GNP and teledensity, but the other variables also showed moderate degree of multicollinearity. The backward regression method used in this study reduced the problem of multicollinearity. Still, the individual regression coefficients should be interpreted with caution.

### External validity

External validity is the extent to which the results of a study can be generalized across populations, settings, and time. This study has low external validity. The predictor variables that emerged as significant for the post-communist countries may not be as significant for another set of countries or another region of the world. However, it is important to note that these predictor variables would still be applicable for another group of countries, but their relative effects on Internet use may vary.

The external validity is also low in terms of applying this framework to a different point in time. It is expected that other variables may become more relevant to global Internet adoption at different points in time. Structural variables such as income and teledensity may be more significant during the early stages of Internet adoption whereas the audience factors may become more critical at later stages. Socioeconomic factors tend to be more important at earlier stages of Internet adoption. Also, income and infrastructure as well as democratization level (the external factors) are likely to act as stronger barriers to adoption than cultural predispositions.

The study captured Internet adoption at one point in time. Relationships between variables may change at different stages of the adoption process. It is important to underscore the dynamic nature of the Internet adoption process. Any research findings become outdated quickly because ICT use is increasing dramatically in all regions of the world (Rodriguez & Wilson, 2000; World Bank, 2001).

This study examined only country-level factors that affect Internet use. Other factors may be influential at the individual or at the institutional level (Arquette, 2002; European Commission, 2001; Norris, 2001). Norris (2001), for instance, proposed the Internet Engagement Model, in which Internet adoption is to be studied at the macro

(country) level, the meso (institutional) level, and the micro (individual) level. Again, this study focused only on the macro level and examined only country-level factors that affect Internet adoption.

Even though the proposed model of Internet adoption was very comprehensive, it did not include every single possible variable that may have an effect on Internet use. Rather, the study explored the significance of a set of variables considered most important for Internet adoption at the country level at this stage of the adoption process.

This study is mostly cross-sectional, which limits the applicability of the findings for future stages of Internet diffusion. Internet diffusion is a process and not a static phenomenon. However, this study captures the adoption process in the post-communist countries at one point in time.

### **Reliability**

Reliability refers to the question if the same technique applied to the same data yields the same results each time. Reliability does not seem to be an issue when using secondary data as was the case in this study. There are no sampling issues involved because the data gathering methods of the original sources are highly reliable. Since the statistical methods were robust, we assert that the study has produced reliable results.

The interpretation of results in multiple regression always brings the question of causality versus correlation. Clearly the correlation coefficients show a strong relationship between the aforementioned independent variables and the dependent variable, but is that relationship causal? Babbie (1995) lists three conditions that must be present in order to claim a causal relationship: (1) time sequence; (2) correlation between cause and effect; and (3) no other possible third variable that causes both the dependent and independent variable.

Close examination of the variables in the current study shows that the first two conditions are met. Let's take religion as an example and test each of the three criteria. Clearly, religion has come into existence before Internet use. Second, the correlation between religion and Internet use is high, as determined by the dummy variable the regression analysis. The third criterion is more difficult to test. Arguably, there is no other variable that affects both religious predispositions and likelihood of Internet use.

### **Suggestions for Future Research**

The Internet is one of the most fascinating new technologies of all time, and research on its adoption around the world is growing. This dissertation explained cross-country determinants of Internet adoption in the post-communist countries. Future research should focus on adoption at the individual and organizational levels to see if different determinants play a role. In addition, future research should examine if the Internet is used differently by different individuals within the post-communist countries. In other words, studies should identify individual demographic characteristics as well as personality factors that affect adoption at the individual level in the post-communist world. In this regard, more qualitative research of Internet adoption and use within the post-communist countries is warranted.

Another venue for future research would be to isolate better proxy variables for the broad set of factors suggested in this analysis. First, it would be desirable to incorporate other cultural variables in addition to religion and test their effect on country-level Internet adoption. Other measures of telecommunications policy such as level of competition or Internet regulation should also be tested in future research. Future studies of cross-country Internet diffusion should incorporate English language as an audience

factor. A better educational variable that should be tested as a determinant of Internet adoption in the future is some specific measure of ICT skills in particular.

Future studies should apply the five-dimensional framework proposed here to a world model of Internet adoption. It will be interesting to see if there are any regional differences in the effects of the predictor variables when applied to all countries. Such studies may help isolate a set of variables that are universally important in the Internet diffusion process.

This was mostly a cross-sectional study of Internet use in the post-communist countries of Eastern Europe and the former Soviet Union. Future studies should also examine the adoption process in the region longitudinally. A comparative study between Western and Eastern European countries is another venue for future research. Such a comparative study would possibly allow researchers to identify additional cultural predispositions that influence Internet adoption. Finally, a comparative study between Western and Eastern European countries longitudinally should also be conducted.

The importance of the Internet for national development is unquestionable. Today the significance of communication technology is more crucial than ever. The main message in a recent World Bank report reads:

Although traditional channels of communication will remain important, the new information and communications technologies hold great potential for broadly disseminating knowledge at low cost, and for reducing knowledge gaps both within countries and between industrial and developing countries. (World Bank, 1999, 56)

This potential of the Internet makes it crucial to understand the driving forces of its adoption at the country level.

The transition countries of Eastern Europe and the former Soviet Union have undergone a unique period of transition since the end of the Cold War. This transition has

proved to be all but easy. A Freedom House report discusses the difficult transition to building a civil society, democracy and market economy in the region as a whole (Karatnycky et al., 1997). The United Nations also underscores the dramatic transformation in the post-communist countries and notes the various costs of transition from totalitarianism to capitalist democracy (UNDP, 1999). The transition has led to social problems, economic downfall, inflation, and deteriorating educational system, among other issues (UNDP, 1999). Transition costs have been so high that some have suggested it is more appropriate to call it the great depression rather than a transition (UNDP, 1999).

When discussing the multidimensional nature of the transition process, it is important to realize that the transition in the former Soviet bloc will not be completed overnight (Fischer et al., 1998). On the contrary, "overcoming institutional legacies and building new, effective institutions is a process that, by definition, will take a long time" (Karatnycky et al., 1997, 21). Increased Internet access and use--even though hardly a panacea--may contribute to making these societies reach their transition goals faster. Higher Internet use may be used to help their development during the challenging transitional period.

What this research has shown is that building a more democratic society leads to increased Internet use. Democratization emerges as more important determinant of Internet adoption than ever before suggested. However, the structural issues of income and infrastructure also remain critical for Internet development in the region. Countries with lower national income and poor telephone infrastructure have to overcome these barriers in order to increase Internet use. But first, a necessary step to enlarging the

information superhighway in the post-communist countries is to open up their societies and increase the political rights and freedoms of their citizens.

## LIST OF REFERENCES

- Agresti, A., & Finley, B. (1997). Statistical methods for the social sciences (3<sup>rd</sup> ed.). Upper Saddle River, NJ: Prentice Hall.
- Ahmann, L. (1998). Internet access and political participation: Can the Internet play a role in strengthening democracy in South Africa? University of Florida: Unpublished Master's Thesis.
- Arnum, E., & Conti, S. (1998). Internet development worldwide: The new superhighway follows the old wires, rails, and roads. Retrieved February 17, 2003, from [http://www.isoc.org/inet98/proceedings/5c/5c\\_5.htm](http://www.isoc.org/inet98/proceedings/5c/5c_5.htm)
- Arquette, Toby J. (2002). Social discourse, scientific method, and the digital divide: Using the Information Intelligence Quotient (IIQ) to generate a multi-layered empirical analysis of digital division. Northwestern University: Unpublished Ph.D. Dissertation. Retrieved February 17, 2003, from <http://www.sla.purdue.edu/people/comm/arquette/2in.pdf>
- Atkin, D., Jeffres, L., & Neuendorf, K. (1998). Understanding Internet adoption as telecommunications behavior. Journal of Broadcasting & Electronic Media, 42(4), 475-490.
- Atkinson, R. D., & Court, R. H. (1998, November). The new economy index: Understanding America's economic transition. Retrieved February 17, 2003, from <http://www.neweconomyindex.org/>
- Babbie, E. (1995). The practice of social research (7<sup>th</sup> ed.). Belmont, CA: Wadsworth.
- Baily, M. N. (2001). U.S. economic performance and the challenge for Europe. Retrieved February 17, 2003, from <http://www.iie.com/papers/baily0601.htm>
- Barua, A., Pinnell, J., Shutter, J., & Whinston, A. B. (1999). Measuring the Internet economy. Retrieved February 17, 2003, from [http://cism.bus.utexas.edu/works/articles/internet\\_economy.pdf](http://cism.bus.utexas.edu/works/articles/internet_economy.pdf)
- Bazar, B., & Boalch, G. (1997). A preliminary model of Internet diffusion within developing countries. Proceedings of the AUSWEB97 Conference, Southern Cross University, Gold Coast, Australia. Retrieved May 7, 2000, from <http://ausweb.scu.edu.au/proceedings/boalch/paper.html>

- Bauer, J. M. (1994). The emergence of global networks in telecommunications: Transcending national regulation and market constraints. Journal of Economic Issues, 28(2), 391-402.
- Beilock, R., & Dimitrova, D. V. (2003). An exploratory model of inter-country Internet diffusion. Telecommunications Policy, 27(3-4), 237-252.
- Berg-Schlosser, D., & Siegler, R. (1990). Political stability and development: A comparative analysis of Kenya, Tanzania, and Uganda. London: L. Rienner Publishers.
- Berners-Lee, T. (1999). Weaving the Web: The original design and ultimate destiny of the World Wide Web by its inventor. San Francisco: Harper Collins.
- Bieler, D., & Stevenson, I. (1998, December). OVUM Report: Internet market forecasts: Global Internet growth, 1998-2005. Retrieved February 17, 2003, from <http://www.gsmdata.com/es53061/repovum2.htm>
- Bruce, R. R. (1999). Overcoming obstacles to liberalization of the telecom sector in Estonia, Poland, the Czech Republic, Slovenia, and Hungary. Washington, D.C.: The World Bank.
- Campbell, R. W. (1995) Soviet and post-Soviet telecommunications: An industry under reform. Boulder, CO: Westview Press.
- Canning, A. (1997). Privatization and competition in Hungarian telecommunications. In D. Ryan (ed.), Privatization and competition in telecommunications (pp. 103-126). Westport, CN: Praeger.
- Caselli, F., & Coleman II, W. J. (2000). The world technology frontier. Retrieved February 17, 2003, from <http://papers.nber.org/papers/w7904>
- Caselli, F., & Coleman II, W. J. (2001). Cross-country technology diffusion: The case of computers. American Economic Review, 91(2), 328-335.
- Castells, M. (1996). The rise of the network society. Cambridge, MA: Blackwell.
- Castells, M. (2001). The Internet galaxy: Reflections on the Internet, business, and society. Oxford: Oxford University Press.
- Center for Democracy and Technology. (2000). Bridging the digital divide: Internet access in Central and Eastern Europe. Retrieved February 17, 2003, from <http://www.cdt.org/international/ceeaccess/report.shtml>
- Christensen, C. (1997). The innovator's dilemma: When new technologies cause great firms to fail. Boston: Harvard Business School Press.

- Christensen, C., Craig, T., & Hart, S. (2001). The great disruption. Foreign Affairs, 80(2), 80-95.
- Central Intelligence Agency. (2000). The world factbook. Retrieved February 17, 2003, from <http://www.cia.gov/cia/publications/factbook/index.html>
- Clarke, G. R. G. (2001, July). Bridging the Digital Divide: How enterprise ownership and foreign competition affect Internet access in Eastern Europe and Central Asia. World Bank Working Paper 2629, Retrieved February 17, 2003, from <http://econ.worldbank.org/view.php?topic=14&type=5&id=2239>
- Colin Xu, L., Li, W., & Zhen-Wei Qiang, C. (2001). The political economy of privatization and competition: Cross-country evidence from the telecommunications sector. CEPR Discussion Paper 2825. Retrieved February 17, 2003, from <http://ideas.repec.org/p/cpr/ceprdp/2825.html>
- Comer, D. E. (1995). Internetworking with TCP/IP (3<sup>rd</sup> ed.). Englewood Cliffs, NJ: Prentice Hall.
- Cortez, M. V. (2000). Internet censorship around the world. Retrieved February 17, 2003, from [http://www.isoc.org/inet2000/cdproceedings/8k/8k\\_4.htm](http://www.isoc.org/inet2000/cdproceedings/8k/8k_4.htm)
- Cyberatlas. (2002). Worldwide Internet population. Retrieved February 17, 2003, from [http://cyberatlas.internet.com/big\\_picture/geographics/article/0,1323,5911\\_151151,00.html](http://cyberatlas.internet.com/big_picture/geographics/article/0,1323,5911_151151,00.html)
- Daly, J. A. (2000, September). Will the Internet promote democracy? iMP Magazine, Retrieved February 17, 2003, from [http://www.cisp.org/imp/september\\_2000/daly/09\\_00daly.htm](http://www.cisp.org/imp/september_2000/daly/09_00daly.htm)
- Daly, J. A. (1999, May). Measuring the impacts of the Internet in the developing world. iMP Magazine, Retrieved February 17, 2003, from [http://www.cisp.org/imp/may\\_99/daly/05\\_99daly.htm](http://www.cisp.org/imp/may_99/daly/05_99daly.htm)
- Daly, J., & Miller, R. (1998). Corporations' use of the Internet in developing countries. Washington, D.C.: The World Bank.
- Dasgupta, S., Lall, S., & Wheeler, D. (2001, March 28). Policy reform, economic growth, and the digital divide: An econometric analysis. World Bank Working Paper 2567, Retrieved February 17, 2003, from <http://econ.worldbank.org/view.php?topic=14&type=5&id=1615>
- de Melo, M., & Gelb, A. (1996). A comparative analysis of twenty-eight transition economies in Europe and Asia. Post-Soviet Geography and Economics, 37(5), 265-285.
- DePrince, A. E., Jr., & Ford, W. F. (1999). A primer on internet economics: Macro and micro impact of the Internet on the economy. Business Economics, 34(4), 42-50.

- DiMaggio, P. (1997). Culture and cognition. Annual Review of Sociology, 23, 263-287.
- Dimitrova, D. V. (2002). Internet uses and gratifications: An online survey of Bulgarians at home and abroad. International Communication Bulletin, 37(1-2), 36-49.
- Dinkova, D. (1998). Bulgaria's Internet: Nonprofit organizations are at the forefront. Economic Reform Today, 3.
- Domanski, H. (2000). On the verge of convergence: Social stratification in Eastern Europe. New York: Central European University Press.
- Drohan, M., & Freeman, A. (1997). Winning the language wars: The world speaks. World Press Review, 6-8.
- Dryden, J. (1998). Realising the potential of global electronic commerce. The OECD Observer, 214. Retrieved February 17, 2003, from [http://oecd.org/publications/observer/214/Article6\\_eng.htm](http://oecd.org/publications/observer/214/Article6_eng.htm)
- El-Nawawy, M. A. (2000). Profiling Internet users in Egypt: Understanding the primary deterrent against their growth in number. Retrieved February 17, 2003, from [http://www.isoc.org/inet2000/cdproceedings/8d/8d\\_3.htm](http://www.isoc.org/inet2000/cdproceedings/8d/8d_3.htm)
- Elie, M. (1998). The Internet and global development. Retrieved February 17, 2003, from [http://www.isoc.org/inet98/proceedings/5d/5d\\_3.htm](http://www.isoc.org/inet98/proceedings/5d/5d_3.htm)
- Ellis, F. (1999). From glasnost to the internet: Russia's new infosphere. New York: St. Martin's Press.
- Estache, A., Manacorda, M., & Valletti, T. M. (2002, March 21). Telecommunication reforms, access regulation, and Internet adoption in Latin America. World Bank Working Paper 2802, Retrieved February 17, 2003, from <http://econ.worldbank.org/view.php?type=5&id=13162>
- European Bank for Reconstruction and Development. (1997). Transition report 1997: Enterprise performance and growth. London: European Bank for Reconstruction and Development.
- European Commission. (2000). Key data on education in Europe, 1999-2000. Luxembourg: Eurostat Press Office.
- European Commission. (2001, March). The digital divide: A research perspective. Report EUR 19913. Retrieved February 17, 2003, from <http://www.fragnersxtreme.com/lemon/eur19913en.pdf>
- Fischer, S., Sahay, R., & Vegh, C. A. (1998, April). How far is Eastern Europe from Brussels? IMF Working Paper WP/98/53. Retrieved February 17, 2003, from <http://www.imf.org>

- Fish, M. S. (1998). The determinants of economic reform in the post-communist world. East European Politics & Societies, 12 (1), 31-78.
- Forrester Research. (2000, August 15). Latin culture and climate explains low Internet adoption in France, Italy, and Spain. Retrieved February 17, 2003, from <http://www.forrester.com/ER/Press/Release/0,1769,377,FF.html>
- Freedom House. (2000). Freedom House country ratings. Retrieved February 17, 2003, from <http://www.freedomhouse.org/ratings/index.htm>
- Garrison, B. (2000). Online information use in newsrooms: A longitudinal diffusion study. Paper presented to the Newspaper Division, Association for Education in Journalism and Mass Communication (AEJMC) conference, Phoenix.
- Global Reach. (2000, September). Global Internet statistics. Retrieved February 17, 2003, from <http://www.glreach.com/globstats/index.php3>
- Godwin, M. (1998). Cyber rights: Defending free speech in the digital age. New York: Times Books.
- Goode, S., & Stevens, K. (2000). An analysis of the business characteristics of adopters and non-adopters of World Wide Web technology. Information Technology and Management, 1, 129-154.
- Gospic, N., Jankovic, M., & Odadzic, B. (2000, August). Yugoslav telecommunications markets: Vision and Potential. IEEE Communications Magazine, 38(8), 112-116.
- Gray, A., & McGuigan, J. (eds.). (1997). Studying culture: An introductory reader (2<sup>nd</sup> ed.). London: Arnold.
- Gruber, H. (2001). Competition and innovation: The diffusion of mobile telecommunications in Central and Eastern Europe. Information Economics and Policy, 13, 19-34.
- Guillen, M. & Suarez, S. (2001). Developing the Internet: Entrepreneurship and public policy in Ireland, Singapore, Argentina and Spain. Telecommunications Policy, 25, 349-371.
- Gujarati, D. (1995). Basic econometrics (3<sup>rd</sup> ed.). New York: McGraw-Hill.
- Gulyas, A. (1998). In the slow lane on the information superhighway: Hungary and the information revolution. Convergence: The Journal of Research into New Media Technologies, 4. Retrieved February 17, 2003, from <http://www.cios.org>
- Gunarante, S. A. (2001). Global triadization: A theoretical framework for global communication research. Paper presented to the Communication Theory and Methodology Division, Association for Education in Journalism and Mass Communication (AEJMC) conference, Washington, D.C.

- Guthrie, R.A., & Austin, L. D. (1996). Competitive implications of the Internet. Information Systems Management, 13(3), 90-91.
- GVU Web Surveys. (1998, October). Retrieved February 17, 2003, from [http://www.gvu.gatech.edu/user\\_surveys/](http://www.gvu.gatech.edu/user_surveys/)
- Hafner, K., & Lyon, M. (1996). Where wizards stay up late: The origins of the Internet. New York: Simon & Schuster.
- Hanson, J., & Narula, U. (1990). New communication technologies in developing countries. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Hargittai, E. (1999). Weaving the Western web: Explaining differences in Internet connectivity among OECD countries. Telecommunications Policy, 23(10/11), 701-718.
- Held, D. (1995). Democracy and the global order: From the modern state to cosmopolitan governance. Stanford, CA: Stanford University Press.
- Hoelschner, G. (2000, August). Profile of the Czech communications market. IEEE Communications Magazine, 38(8), 77-80.
- Hofstede, G. (1980). Culture's consequences: International differences in work-related values. Beverly Hills, CA: Sage.
- Hofstede, G. (2001). Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Horvath, J. (2002). Trouble in cyberspace. Telepolis. Retrieved February 17, 2003, from <http://www.telepolis.de/english/inhalt/te/12520/1.html>
- Howard, P.E.N., L. Rainie, & Jones, S. (2001). Days and nights on the Internet: The impact of a diffusing technology. American Behavioral Scientist, 45(3), 383-404.
- International Monetary Fund. (2000a). World economic outlook: Asset prices and the business cycle. Retrieved February 17, 2003, from <http://www.imf.org>
- International Monetary Fund. (2000b). Dissemination standards bulletin board. Retrieved February 17, 2003, from <http://dsbb.imf.org/>
- International Telecommunication Union. (1999). Challenges to the network: Internet for development. Geneva: ITU.
- International Telecommunication Union. (2000). World telecommunication indicators. Retrieved February 17, 2003, from <http://www.itu.ch/ti/>

- International Telecommunication Union. (2001). Telecommunication regulation and privatization data: Country profiles. Retrieved February 17, 2003, from [http://www7.itu.int/treg/profiles2/cntryprfiles/Build\\_Guide.asp](http://www7.itu.int/treg/profiles2/cntryprfiles/Build_Guide.asp)
- Jamison, M. (1995). A competitive framework for pricing interconnection in a global telecommunications market. Denver Journal of International Law and Policy, 23(3), 513-533.
- Jasinski, P. (1997). Competition rules and regulations in telecommunications: The case of Poland's intent to join the EU. In D. Ryan (ed.), Privatization and competition in telecommunications (pp. 127-148). Westport, CN: Praeger.
- Jisi, W., Yunus, M., Somavia, J., & Mesquita, R. L. (2001). Crossing the digital divide: The Internet in China: A new fantasy? New Perspectives Quarterly, 18(1), 22-24.
- Jones, H. B. (1997, July). The Protestant ethic: Weber's model and the empirical literature. Human Relations, 50(7), 757-798.
- Jupiter Research Press Release. (2001a, January 11). Retrieved February 17, 2003, from [http://www.jmm.com/xp/jmm/press/2001/pr\\_011101.xml](http://www.jmm.com/xp/jmm/press/2001/pr_011101.xml)
- Jupiter Research Press Release. (2001b, January 18). Retrieved February 17, 2003, from [http://www.jmm.com/xp/jmm/press/2001/pr\\_011801.xml](http://www.jmm.com/xp/jmm/press/2001/pr_011801.xml)
- Karatnycky, A., Motyl, A., & Shor, B. (eds.). (1997). Nations in transit: 1997: Civil society, democracy and markets in East Central Europe and the Newly Independent States. New Brunswick: Transaction Publishers.
- Katchanovski, I. (2000). Divergence in growth in post-communist countries. Journal of Public Policy, 20(1), 55-81.
- Katz, J. E., Rice, R. E., & Aspden, P. (2001). The Internet, 1995-2000: Access, civic involvement, and social interaction. American Behavioral Scientist, 45(3), 405-419.
- Kennedy, P. (1998). A guide to econometrics (4<sup>th</sup> ed.). Cambridge, MA: The MIT Press.
- Kiiski, S., & Pohjola, M. (2001, June). Cross-country diffusion of the Internet. UNU/WIDER Discussion Paper 2001/11. Retrieved February 17, 2003, from [www.wider.unu.edu/publications/dps/DP2001-11.pdf](http://www.wider.unu.edu/publications/dps/DP2001-11.pdf)
- Kleinbaum, D. G., Kupper, L. L., & Muller, K. E. (1998). Applied regression analysis and other multivariable methods. Boston, MA: PWS-KENT Publishing Co.
- Kouznetsov, A., & Bourtsev, D. (1996). Prospects for the development of the Internet in Russia. INET Conference Proceedings. Retrieved February 17, 2003, from [http://www.isoc.org/isoc/whatis/conferences/inet/96/proceedings/h1/h1\\_2.htm](http://www.isoc.org/isoc/whatis/conferences/inet/96/proceedings/h1/h1_2.htm)

- Kuentzel, D., Sloutski, L., & Sokolov, N. (2000, December). Evolution of telecommunication in Eastern Europe. IEEE Communications Magazine, 38(8), 143-149.
- Lamberton, D. (1997). The new research frontiers of communications policy. Amsterdam, The Netherlands: Elsevier.
- Lari, E. F. (2000). International institutions in Eastern Europe: Into the financial breach. Harvard International Review, 13(1), 18.
- Leiner, B. M., Vinton G. Cerf, V. C., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., Postel, J., Roberts, L. G., & Wolff, S. (1997). A brief history of the Internet. Retrieved February 17, 2003, from <http://www.isoc.org/internet/history/brief.html>
- Lin, C. (1998). Exploring personal computer adoption dynamics. Journal of Broadcasting & Electronic Media, 42(1), 95-112.
- Lin, C. (1999). Online-service adoption likelihood. Journal of Advertising Research, 39(2), 79-89.
- Lin, N. (1993). Diffusion of information technology: A case study of computer network and the role of government, industry, and academia in developing the Internet/NREN. University of Texas Austin: Unpublished Ph.D. Dissertation.
- Lindstrom, P. (1997). The Internet: Nielsen's longitudinal research on behavioral changes in use of this counterintuitive medium. Journal of Media Economics, 10(2), 35-40.
- Maddala, G. (1984). Limited-dependent and qualitative variables in econometrics. Cambridge: Cambridge University Press.
- Maddock, R. (1997). Telecommunications and economic development. In D. Lamberton (ed.), The new research frontiers of communications policy (pp. 159-175). Amsterdam, The Netherlands: Elsevier.
- Madon, S. (2000). The Internet and socio-economic development. Information Technology and People, 13(2), 85-101.
- Magyar, B., & Karvalics, L. Z. (2001). "Information society" in Eastern Europe? Chances, possibilities, tasks and programs. East European Quarterly, XXXIV, 4.
- Maherzi, A. (1997). World communication report: The media and the challenge of the new technologies. Paris: UNESCO Publishing.
- Mahler, A., & Rogers, E. (1999). The diffusion of interactive communication innovations and the critical mass: The adoption of telecommunications services by German banks. Telecommunications Policy, 23, 719-740.

- Maitland, C. (1998). Global diffusion of interactive networks: The impact of culture. Electronic Journal of Communication, 8. Retrieved February 17, 2003, from <http://www.cios.org>
- Malecki, E. J. (1997). Technology and economic development: The dynamics of local, regional and national competitiveness (2<sup>nd</sup> ed.). Harlow, England: Longman.
- Malecki, E. J. (2000). Knowledge and regional competitiveness. Erdkunde, 54(4), 334-351.
- Malecki, E. (2001). The Internet age: Not the end of geography. In Felsenstein, D., & Taylor, M.J. (eds.) Promoting local growth: Process, practice and policy. Aldershot: Ashgate.
- McChesney, R. (1999). Rich media, poor democracy: Communication politics in dubious times. Urbana: University of Illinois Press.
- McElhinney, S. (2001). Telecommunications liberalisation and the quest for universal service in Australia. Telecommunications Policy, 25, 233-248.
- McKnight, L. W., & Bailey, J. (1997). Internet economics. Cambridge, MA: MIT Press.
- McLuhan, M., & Powers, B. R. (1989). The global village: Transformations in world life and media in the 21<sup>st</sup> century. New York: Oxford University Press.
- Media Metrix Global Services. (2000). Retrieved February 17, 2003, from <http://www.comscore.com/metrix/gs.asp>
- Mendoza, M., & Alvarez de Toledo. (1997). Demographics and behavior of the Chilean Internet population. Journal of Computer-Mediated Communication, 3(1). Retrieved February 17, 2003, from <http://www.ascusc.org/jcmc/vol3/issue1/mendoza.html>
- Michalis, M., & Takla, L. (1997). Telecommunications in the Czech Republic: The privatization of SPT Telecom. In D. Ryan (ed.), Privatization and competition in telecommunications (pp. 89-102). Westport, CN: Praeger.
- Minges, M. (2000). Counting the Net: Internet access indicators. Retrieved February 17, 2003, from [http://www.isoc.org/inet2000/cdproceedings/8e/8e\\_1.htm](http://www.isoc.org/inet2000/cdproceedings/8e/8e_1.htm)
- Minges, M. (2001). Internet around the world. Retrieved February 17, 2003, from [http://www.isoc.org/inet2001/CD\\_proceedings/G54/Inet2001\\_100501.htm](http://www.isoc.org/inet2001/CD_proceedings/G54/Inet2001_100501.htm)
- Mitchell, W. J. (1995). City of bits: Space, place, and the infobahn. Cambridge: MIT Press.
- Nelson, R. R. (1993). National innovation systems. New York: Oxford University Press.

- Network Wizards Internet Domain Survey. (2000). Retrieved February 17, 2003, from <http://www.isc.org/ds/>
- Newhagen, J., & Rafaeli, S. (1996). Why communication researchers should study the Internet: A dialogue. *Journal of Communication*, 46, 4-13.
- Nielsen NetRatings. (2000). Retrieved February 17, 2003, from <http://www.nielsen-netratings.com>
- Nielsen NetRatings. (2002). Retrieved February 17, 2003, from <http://www.nielsen-netratings.com>
- Norris, P. (2000). The worldwide digital divide: Information poverty, the Internet and development. Paper presented at the annual meeting of the Political Studies Association, London School of Economics and Political Science, UK. Retrieved February 17, 2003, from <http://www.ksg.harvard.edu/iip/governance/psa2000dig.pdf>
- Norris, P. (2001). Digital divide: Civic engagement, information poverty and the Internet in democratic societies. New York: Cambridge University Press.
- National Telecommunications and Information Administration. (1995, July). Falling through the Net: A survey of the "have nots" in rural and urban America. Retrieved February 17, 2003, from <http://www.ntia.doc.gov/ntiahome/fallingthru.html>
- National Telecommunications and Information Administration. (1998, July). Falling through the Net II: New data on the digital divide. Retrieved February 17, 2003, from <http://www.ntia.doc.gov/ntiahome/net2>
- National Telecommunications and Information Administration. (1999, July). Falling through the Net: Defining the digital divide. Retrieved February 17, 2003, from <http://www.ntia.doc.gov/ntiahome/ftn99/contents.html>
- Nua's Internet user surveys. (2002, September). Retrieved February 17, 2003, from <http://www.nua.ie>
- Oaca, N. (2000, August). Mobile telephony: The main driver of Romanian telecommunications! *IEEE Communications Magazine*, 38(8), 98-104.
- Organization for Economic Cooperation and Development. (1998a, October). Internet infrastructure indicators. Retrieved February 17, 2003, from <http://www.oecd.org/dsti/sti/it/cm/prod/tisp98-7e.htm>
- Organization for Economic Cooperation and Development. (1998b). Internet traffic exchange: Developments and policy. Retrieved February 17, 2003, from <http://www.oecd.org/dsti/sti/it/cm/prod/traffic.htm>

- Paltridge, S. (2000). Local access pricing and the international digital divide. Retrieved February 17, 2003, from <http://www.isoc.org/oti/articles/1000/paltridge.html>
- Papir, Z., & Oleszak, P. (2000, August). The communications market in Poland. IEEE Communications Magazine, 38(8), 91-95.
- Perrit, H. H. (1999, February). The Internet as a threat to sovereignty? Thoughts on the Internet's role in strengthening national and global governance. Retrieved February 17, 2003, from <http://www.law.indiana.edu/glsj/vol5/no2/4perrit.html>
- Petrazzini, B., & Guerrero, A. (2000). Promoting Internet development: The case of Argentina. Telecommunications Policy, 24(2), 89-112.
- Pew Center for the People and the Press. (1995). Technology in the American Household. Washington, D.C.: Pew Center for the People and the Press.
- Pitkow, J. (1996). Emerging trends in the WWW user population. Communications of the ACM, 39(6), 106-108.
- Poster, M. (1995). CyberDemocracy: Internet and the public sphere. Retrieved February 17, 2003, from <http://www.hnet.uci.edu/mposter/writings/democ.html>
- Poster, M. (2001). What's the matter with the Internet. Minneapolis, MN: University of Minnesota Press.
- Prescott, M. B., & Van Slyke, S. (1997). Understanding the Internet as an innovation. Industrial Management and Data Systems, 97(3), 119-124.
- Press, L. (1997, November). Tracking the global diffusion of the Internet. Communications of the ACM, 40(11), 11-17.
- Press, L., Burkhart, G., Foster, W., Goodman, S., Wolcott, P., & Woodard, J. (1998). An Internet diffusion framework. Communications of the ACM, 41(10), 21-26.
- Pritchett, L., & Kaufmann, D. (1998, March). Civil liberties, democracy, and the performance of government projects. Finance & Development. Retrieved February 17, 2003, from <http://www.worldbank.org/fandd/english/pdfs/0398/0140398.pdf>
- Rey, L. (1998). Multiculturalism and communication technologies in Switzerland. Electronic Journal of Communication, 8. Retrieved February 17, 2003, from <http://www.cios.org/getfile>
- Research on Internet in Slovenia. (2000). Retrieved February 17, 2003, from <http://www.ris.org/ict.html>
- Rodriguez, F., & Wilson, E. J. (2000, May). Are poor countries losing the information revolution? Retrieved February 17, 2003, from <http://www.infodev.org/library/WorkingPapers/wilsonrodriguez.doc>

- Rogers, E. (1995). Diffusion of innovations (4<sup>th</sup> ed.). New York: Free Press.
- Rogerson, K., & Thomas, D. G. (1998). Internet regulation process model: The effect of societies, communities, and governments. Journal of Political Communication, 15, 427-444.
- Roller, L., & Waverman, L. (2001). Telecommunications infrastructure and economic development: A simultaneous approach. American Economic Review, 91(4), 909-923.
- Romer, P. (1999). What makes technology grow? The Wilson Quarterly, 23(2), 11-13.
- Rood, M. (1999). A word about Internet statistics. Telecommunications Policy, 23(10/11), 687-688.
- Rose, R. (2002). Digital divide or digital diffusion? Transition, 13(4-5), 33-35.
- Ryan, D. (1997). Privatization and competition in telecommunications. Westport, CN: Praeger.
- Ryan, B., & Gross, N. C. (1943). The diffusion of hybrid seed corn in two Iowa communities. Rural Sociology, 8, 15-24.
- Sadowsky, G. (1993). Network connectivity for developing countries. Communications of the ACM, 36(8), 42-47.
- Sale, K. (1999). The triumph of technology. The Ecologist, 29(3), 187-188.
- Sallai, G. (2000, August). Reform and development of Hungarian telecommunications. IEEE Communications Magazine, 38(8), 82-87.
- Sen, A. (1999a). Democracy as a universal value. Journal of Democracy, 10(3), 3-17.
- Sen, A. (1999b). Development as freedom. New York: Knopf.
- Severin, W. J., & Tankard, J. W., Jr. (1997). Communication theories: Origins, methods, and uses in the mass media (4<sup>th</sup> ed.). New York: Longman.
- Shapiro, C., & Varian, H. R. (1999). Information rules: A strategic guide to the network economy. Boston, MA: Harvard Business School Press.
- Singh, J. P. (1999). Leapfrogging development? The political economy of telecommunications restructuring. Albany, NY: State University of New York Press.
- Sokolov, N., & Goldenstein, B. (2000, August). Telecommunications in Russia. IEEE Communications Magazine, 38(8), 106-111.

- Solomon, N. (1998). Internet shopping network: The malling of cyberspace. Retrieved February 17, 2003, from <http://www.fair.org/media-beat/981029.html>
- Sondergaard, M. (1994). Hofstede's consequences: A study of reviews, citations and replications. Organization Studies, 15(3), 447-456.
- Standage, T. (1998). The Victorian internet: The remarkable story of the telegraph and the 19<sup>th</sup> century's on-line pioneers. New York: Walker.
- Stevens, J. (1992). Applied multivariate statistics for the social sciences (2<sup>nd</sup> ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Stewart, C. M., Shields, S. F., & Sen, N. (1998). Diversity in on-line discussions: A study of cultural and gender differences in listservs. Electronic Journal of Communication, 8. Retrieved February 17, 2003, from <http://www.cios.org/getfile>
- Tanner, E. (1999). Links to the world. Gazette: International Journal for Communication Studies, 61(1), 39-57.
- Tarde, G. (1903). The laws of imitation. New York: H. Holt and Company.
- Tayeb, M. (1994). Organizations and national culture: Methodology considered. Organization Studies, 15(3), 429-446.
- Tele-haves and have-nots: Developing countries make use of technological innovations. (1996, May 18). The Economist, 19-20.
- The cyber challenge. (2000, July 3). Transitions Online. Retrieved February 17, 2003, from <http://www.tol.cz/jul00/thecyber.html>
- The Internet's new borders. (2001, August 11). The Economist, 9-10.
- The new economy. (2000, September 23). The Economist, 5-40.
- Tobin, J. (1958). Estimation of relationships for limited dependent variables. Econometrica, 26, 24-36.
- United Nations Development Programme. (1999). Transition 1999: Human development report for Central and Eastern Europe and the CIS. New York: UNDP.
- United States Agency for International Development. (2000). Bulgaria assessment: Internet environment for economic development. Retrieved February 17, 2003, from [http://www.usaid.gov/info\\_technology/ied/reports/bulgaria/environment.html](http://www.usaid.gov/info_technology/ied/reports/bulgaria/environment.html)
- United States Census Bureau. (1997, October). Computer use and ownership. Retrieved February 17, 2003, from <http://www.census.gov/population/www/socdemo/computer.html>

- United States Commerce Department. (1998, April). The emerging digital economy. Retrieved February 17, 2003, from <http://www.ecommerce.gov/emerging.htm>
- United States Internet Council. (2000, September). State of the Internet 2000. Retrieved February 17, 2003, from <http://www.usic.org/papers/stateoftheinternet2000/intro.html>
- Wallraff, B. (2000, November). What global language? The Atlantic Monthly, 52-66.
- Wallsten, S. (1999). An empirical analysis of competition, privatization, and regulation in telecommunications markets in Africa and Latin America. World Bank Working Paper 2817, Retrieved February 17, 2003, from <http://ideas.repec.org/p/wop/wobago/2136.html>
- Wallsten, S. (2002, March 25). Does sequencing matter? Regulation and privatization in telecommunications reforms. World Bank Working Paper 2817, Retrieved February 17, 2003, from <http://econ.worldbank.org/view.php?type=5&id=13266>
- Weir, T. (1999). Innovators or news hounds? Newspaper Research Journal, 20(4), 62-81.
- Wheatley, J. (1999). World telecommunications economics. London: The Institution of Electrical Engineers.
- Wilson, B., Ryder, M., McCahan, J., & Sherry, L. (1996). Cultural assimilation of the Internet: A case study. Retrieved February 17, 2003, from <http://carbon.cudenver.edu/~bwilson/cultass.html>
- Winner, L. (1997) Technology today: Utopia or dystopia? Social Research, 64(3), 989-1008.
- Winston, B. (1998). Media technology and society: A history: From the telegraph to the Internet. London: Routledge.
- Wolcott, P., Press, L., McHenry, W., Goodman, S., & Foster, W. (2001). A framework for assessing the global diffusion of the Internet. Journal of the Association for Information Systems, 2(6). Retrieved February 17, 2003, from [http://www.istis.unomaha.edu/isqa/wolcott/GDI/2001\\_GDI\\_Framework.htm](http://www.istis.unomaha.edu/isqa/wolcott/GDI/2001_GDI_Framework.htm)
- World Bank. (1998). World development indicators. Washington, D.C.: The World Bank.
- World Bank. (2000). World development indicators. Washington, D.C.: The World Bank.
- World Bank. (2001). World development indicators. Washington, D.C.: The World Bank.
- World Intellectual Property Organization. (2001). Primer on electronic commerce and intellectual property issues. Retrieved February 17, 2003, from <http://ecommerce.wipo.int/primer/section1.html>

- Xavier, P. (2000). Market liberalisation and regulation in Hungary's telecommunications sector. Telecommunications Policy, 24(10/11), 807-841.
- Yakovlev, Y. (1989). Flagship of Glasnost. In Cohen S., & vanden Heuvel, K. (eds.) Voices of Glasnost: Interviews with Gorbachev's Reformers (pp. 197-212). New York: Norton.
- Zook, M. (2000). Internet metrics: Using host and domain counts to map the internet. Telecommunications Policy, 24(6/7), 613-620.
- Zook, M. (2002). Zooknic Internet intelligence: Internet users worldwide. Retrieved February 17, 2003, from <http://www.zooknic.com/Users/index.htm>

### BIOGRAPHICAL SKETCH

Dimitrova received a Master of Arts in journalism and communication from the University of Oregon in 1999. She holds a Bachelor of Arts degree in journalism/mass communication and political science/international relations from the American University in Bulgaria (AUBG). Dimitrova's professional background is in radio and television news.

Daniela Dimitrova conducts research in the area of new media and the Internet. Her research interests include Internet use at both the micro and macro level. She has examined the content and design of online media in previous studies, focusing on the use of hyperlinks, multimedia and interactivity. In addition, Dimitrova's research focuses on political communication and online media management.



I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.




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Associate Professor of Journalism and  
Communications

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Kurt Kent  
Professor of Journalism and  
Communications

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



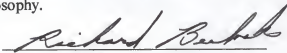
Melinda McAdams  
Professor of Journalism and  
Communications

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Wayne Wanta  
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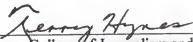
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